SOIL SURVEY OF

Brown County, Wisconsin

United States Department of Agriculture
Soil Conservation Service
In cooperation with

Wisconsin Agricultural Experiment Station

Issued June 1974

Major fieldwork for this soil survey was done in the period 1966–69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. This survey was made cooperatively by the Soil Conservation Service and the Wisconsin Agricultural Experiment Station. The field mapping and preparation of the soil survey were sponsored and financed in part through a joint agreement between the Soil Conservation Service and the Brown County Regional Planning Commission. The survey is part of the technical assistance furnished to the Brown County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Brown County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group, the shrub and vine group, and the wildlife group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and woodland groups.

Foresters and others can refer to the subsection "Woodland and Community Planting," where the soils of the county are grouped according to their suitability for forest trees and for trees in various kinds of plantings.

Game managers, sportsmen, and others can find information about soils and wildlife in the subsection "Use of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the subsections "Engineering Uses of the Soils" and "Use of the Soils for Recreation."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Brown County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County" and in the information given at the beginning of the publication.

Cover: **A shaped and seeded waterway through an area of Kewaunee and Manawa soils of association 1. This waterway reduces the amount and velocity of runoff and the loss of sediment that would contribute to the pollution of streams.**

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Issued June 1974

SOIL SURVEY OF BROWN COUNTY, WISCONSIN

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE WISCONSIN AGRICULTURAL EXPERIMENT STATION

BROWN COUNTY is on the south end of Green Bay in the northeastern part of Wisconsin (fig. 1). It is bordered by Kewaunee County on the east, by Manitowoc and Calumet Counties on the south, by Outagamie and Shawano Counties on the west, and by Oconto County on the north. The total land area is 336,000 acres.

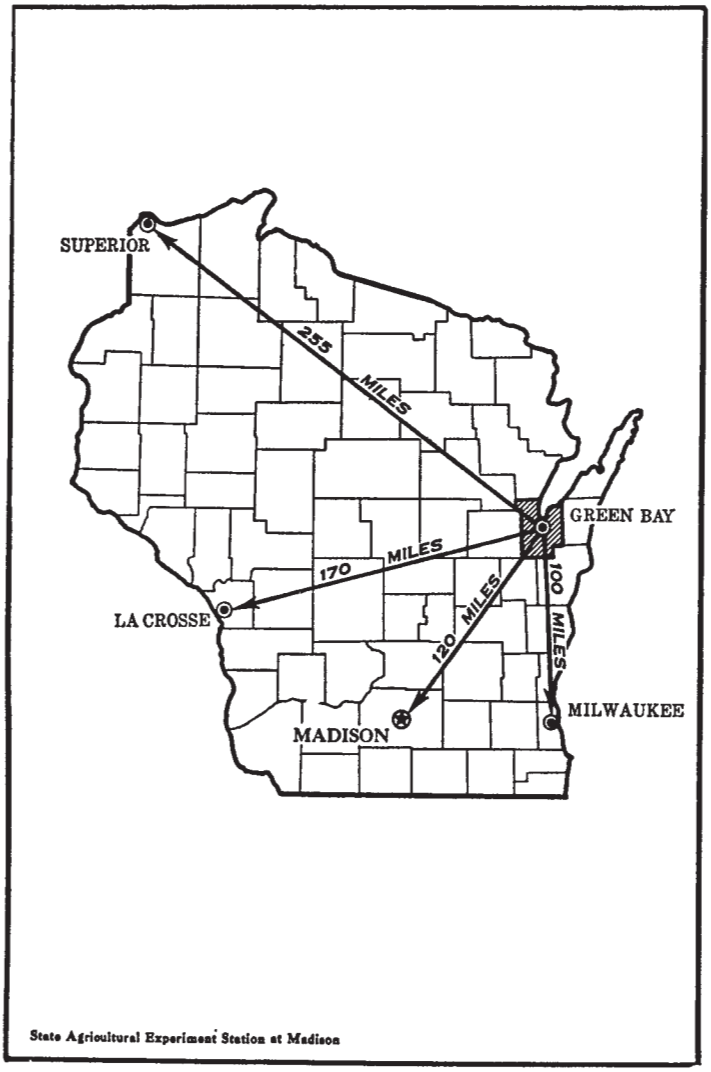

Figure 1.—Location of Brown County in Wisconsin.

Green Bay, located at the mouth of the Fox River on Green Bay, is the largest city in the county. The population was 89,300 in 1970. In the metropolitan area are the city of De Perre, village of Howard, and urbanized parts of the towns of Allouez, Ashwaubenon, Bellevue, Hobart, and Scott. Other cities in the county are Denmark, Pulaski, and Wrightstown, each with a population of less than 3,000.

Manufactured products provide more income to the county than other products. Papermaking and other related industries are the dominant types of manufacturing. The Port of Green Bay ranks second in the State in tonnage of freight handled.

Dairy farming is the main source of farm income. In 1970 about 75 percent of the county was in farms. This figure is rapidly diminishing because of residential and industrial development. Common farm crops are alfalfa, oats, and corn.

The topography of Brown County is modified by glaciation and is influenced, to a large extent, by underlying bedrock. Gently sloping topography is dominant. The Niagara escarpment is the most conspicuous topographic feature in the county. It extends in an almost continuous line from the northeastern corner of the county to the southwestern corner. The Fox River, a few miles to the west, is about parallel with the escarpment. An area of steep hills and kettles is in the southeastern corner of the county.

Most of the soils of the county formed in glacial till and lake sediment that are high in content of clay. The characteristic subsoil and substratum are reddish-brown, slowly permeable clay loam to clay. These soils have slight to moderate limitations for farming. Wetness and maintenance of tilth are the greatest management concerns. Slow permeability and unfavorable shrink-swell potential impose moderate to severe limitations for many uses related to residential and industrial development, including construction of highways and locating and constructing disposal fields for septic tanks.

Other soils of Brown County formed in loamy or sandy glacial till, outwash sand and gravel, and lacustrine sediment. The moderate to rapid permeability and friable

consistence of these soils provide, for the most part, slight to moderate limitations for farming and slight to moderate limitations for most uses in residential and industrial development.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Brown County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Kewaunee and Oshkosh, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Kewaunee silt loam, 2 to 6 percent slopes, is one of several phases within the Kewaunee series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit, the soil complex, is shown on the soil map of Brown County.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Kewaunee-Sisson complex, 15 to 30 percent slopes, eroded. In most survey areas there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Alluvial land is a land type in Brown County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Brown County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoni-

ness, drainage, and other characteristics that affect their management.

The 10 associations in Brown County are discussed in the following pages.

1. Kewaunee-Manawa Association

Deep, well-drained to somewhat poorly drained, nearly level to steep soils that have a dominantly clayey subsoil; on glacial till plains and ridges

This association consists of gently sloping to steep soils on glacial till plains and ridges, and of nearly level or very gently sloping soils in depressions and drainageways (fig. 2). It occupies about 39 percent of the county.

Kewaunee soils make up about 62 percent of this association, and Manawa soils, about 15 percent. Minor soils make up the remaining 23 percent.

The Kewaunee soils are well drained and moderately well drained. They are gently sloping to moderately steep and are on glacial till plains and ridges and along drainageways. Their surface layer is sandy loam or silt loam about 8 inches thick, and the subsoil is reddish-brown silty clay loam and silty clay about 19 inches thick. The substratum is reddish-brown heavy clay loam or silty clay.

The Manawa soils are somewhat poorly drained. They are nearly level or very gently sloping and are in depressions and in drainageways of the glacial till plain. The Manawa soils in drainageways generally are very gently sloping. They have a surface layer of sandy loam or silty clay loam about 8 inches thick. The subsoil is about 22 inches thick and is reddish-brown clay loam, and silty clay loam or silty clay mottled with yellowish red, gray, and dark gray. The substratum is reddish-brown heavy clay loam or silty clay mottled with strong brown.

Minor soils in this association are Poygan soils in ponded depressions, Bellevue soils on flood plains, and Kolberg soils in the vicinity of the Niagara escarpment. The Kolberg soils are underlain by limestone bedrock at a depth of less than 40 inches.

The soils throughout most of this association are cultivated and are suited to all the crops commonly grown in the county. Commonly grown crops are oats, corn, and alfalfa and bromegrass for hay. Uncultivated areas are in pasture or are wooded. Controlling erosion on the Kewaunee soils and providing drainage on the Manawa soils are important management concerns. Maintaining soil tilth and fertility are management concerns for both the Kewaunee and Manawa soils.

The clayey subsoil and substratum are severe limitations to use of these soils for home sites or other nonfarm purposes. If the soils are used as a site for a septic tank filter field, overflow is likely to occur because of the slow permeability of the soil material. The high shrink-swell potential affects excavation and stability where a foundation is to be constructed.

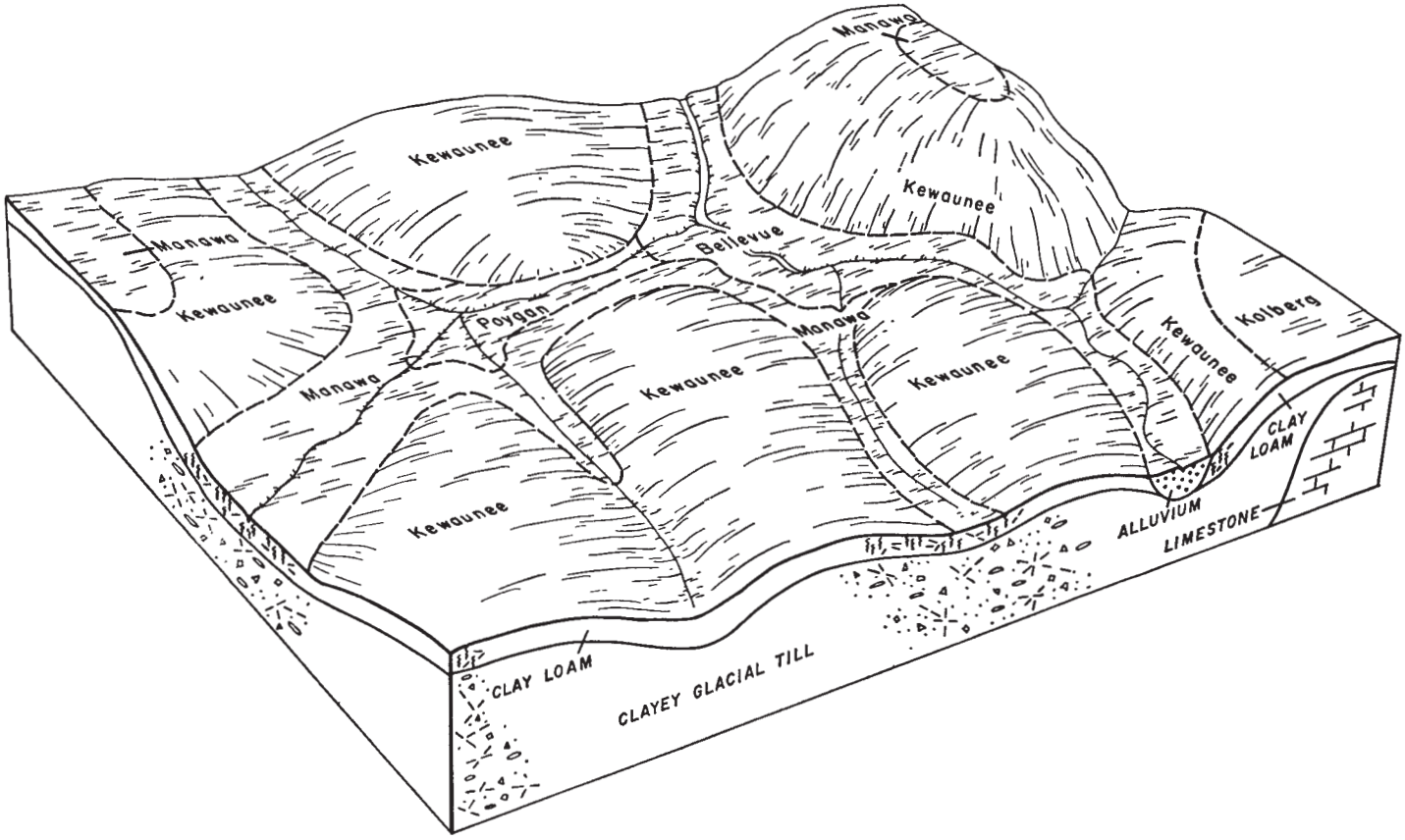

Figure 2.—**Parent material and typical pattern of soils of association 1.**

2. Oshkosh-Manawa Association

Deep, well-drained to somewhat poorly drained, nearly level to steep soils that have a dominantly clayey subsoil; on glacial lake plains dissected by narrow V-shaped valleys

This association consists of soils of glacial lake plains in basins and slack water areas associated with moraines (fig. 3). It occupies about 16 percent of the county.

Oshkosh soils make up about 60 percent of this association; Manawa soils, 9 percent; and minor soils, the remaining 31 percent.

Oshkosh soils are nearly level to steep, and they are well drained to moderately well drained. They have a surface layer of silt loam, sandy loam, or silty clay loam about 7 inches thick. The subsoil is dark reddish-gray and reddish-brown silty clay about 22 inches thick, and the substratum is reddish-brown silty clay.

Manawa soils are mostly nearly level, and they are somewhat poorly drained. They are in depressions and drainageways. These soils have a surface layer of sandy loam or silty clay loam about 8 inches thick. The subsoil is reddish-brown clay loam and silty clay loam or silty clay about 22 inches thick. It is mottled yellowish red, gray, and dark gray. The substratum is reddish-brown heavy clay loam or silty clay. It has strong-brown mottles.

Minor soils in this association are Poygan, in ponded depressions, and small areas of Briggsville, Bellevue, Manistee, and Allendale soils on lake plains and bottom land throughout the association.

The soils throughout most of this association are cultivated and are suited to all the crops commonly grown in the county. Common crops are oats, corn, alfalfa, and bromegrass for hay. Uncultivated areas are in pasture or are wooded. Controlling erosion on the Oshkosh soils and providing drainage on the Manawa soils are primary concerns in management. Maintaining good soil tilth and fertility is also necessary for the satisfactory growth of plants.

The clayey subsoil and substratum of soils in this association severely limit their use for homesites and other nonfarm purposes. The slow permeability of the soils hinders the operation of septic tank filter fields, and shrink-swell potential affects the use of the soils for excavation where a foundation is to be constructed.

3. Shawano-Boyer-Sisson Association

Deep, excessively drained and well-drained, nearly level to steep soils that have a sandy and loamy subsoil; on outwash plains and ridges and glacial lake plains

This association consists of nearly level soils on glacial lake plains and outwash plains and of gently sloping to steep soils on outwash ridges (fig. 4). It occupies about 13 percent of the county.

Shawano soils make up about 10 percent of the association; Boyer soils, 8 percent; Sisson soils, 6 percent; and minor soils, the remaining 76 percent.

Shawano soils are excessively drained. They are on outwash plains and ridges. These soils have a surface

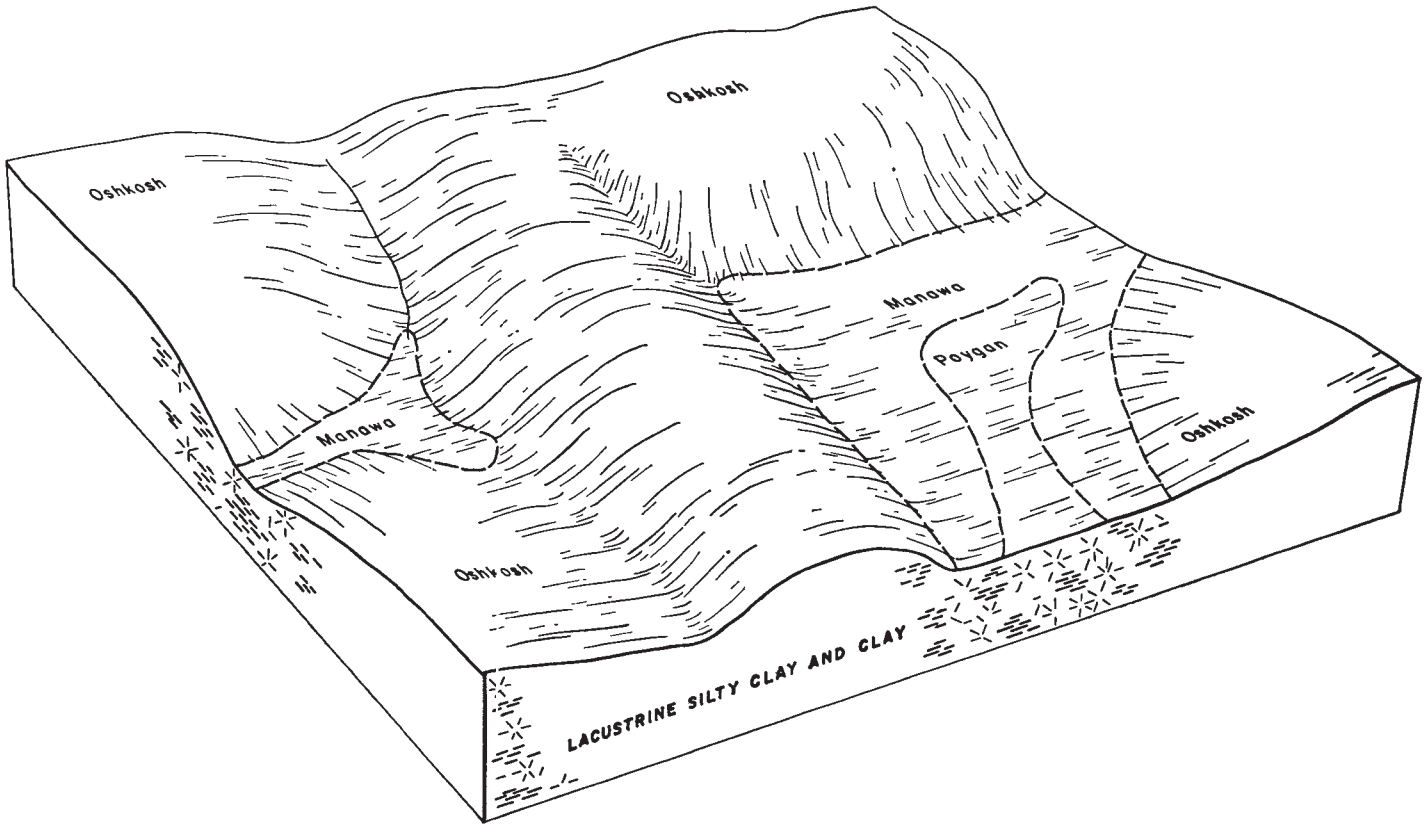

Figure 3.—Parent material and typical pattern of soils of association 2.

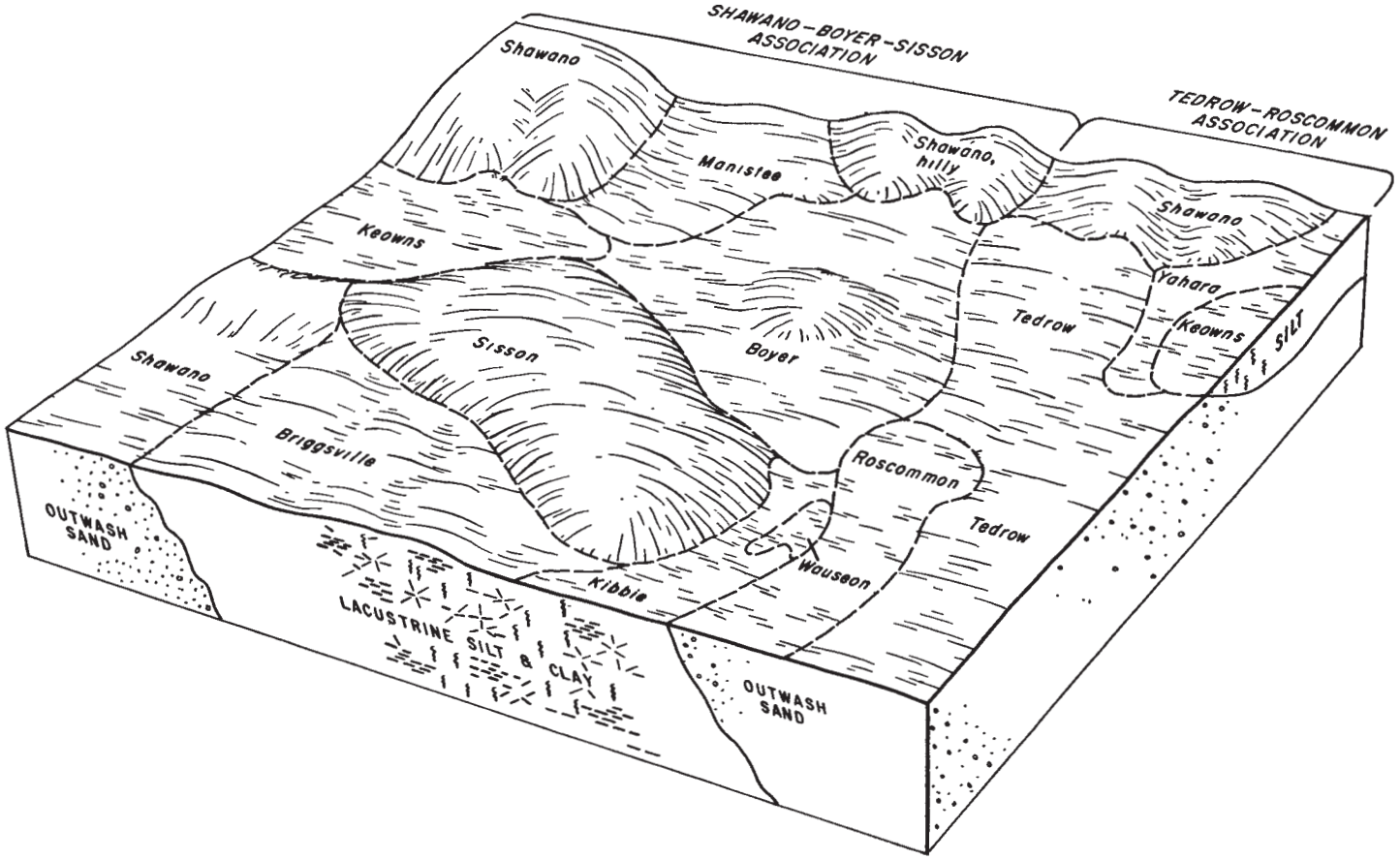

Figure 4.—**Parent material and typical pattern of soils of associations 3 and 7.**

layer of loamy fine sand or fine sand about 10 inches thick. The subsoil and substratum are fine and medium sand.

Boyer soils are well drained. They are on outwash plains and ridges. These soils have a surface layer of loamy fine sand about 6 inches thick and a fine sand subsurface layer about 12 inches thick. The subsoil is sandy loam to light sandy clay loam about 17 inches thick. The substratum typically is fine and medium sand that contains stratified gravel and coarse sand in places.

Sissons soils are on glacial lake plains. They have a surface layer of fine sandy loam or silt loam about 8 inches thick. The subsoil is silt loam and light silty clay loam about 17 inches thick, and the substratum is stratified silt and very fine sand.

Minor soils in this association are of the Briggsville, Kibbie, Keowns, Manistee, and Wauseon series. They occur without pattern throughout the association. Other small areas are occupied by the same kind of soils as those in adjoining soil associations. These small areas are unevenly distributed, and it is difficult to separate them into the proper association.

Sissons soils are well suited to crops and are often used for green beans, peas, sweet corn, and other speciality crops. Use of the soils in the association varies greatly. Some areas are used as woodland, some are farmed, and others are used intensively for residential and industrial development.

4. Waymor-Hochheim Association

Deep, well-drained, nearly level to moderately steep soils that have a loamy subsoil; on glacial till plains and ridges

This association consists of nearly level to moderately steep soils of glacial till plains and ridges. It occupies about 12 percent of the county.

Waymor soils make up about 60 percent of the association and Hochheim soils about 8 percent. The remaining 32 percent is minor soils.

Waymor soils have a silt loam or sandy loam surface layer about 9 inches thick and a silt loam or sandy loam subsurface layer about 4 inches thick. The subsoil is mainly reddish-brown silty clay loam and clay loam about 21 inches thick. The substratum is brown loam.

Hochheim soils have a loam surface layer about 7 inches thick. The subsoil is yellowish-red and brown clay loam, sandy clay loam, and loam about 12 inches thick. The substratum is very pale brown sandy loam.

Among the minor soils in this association are the Manawa and Poygan soils, which are scattered throughout the association; Lamartine and Pella soils, in drainageways and depressions in the southeastern part of the association; and Sisson and Kibbie soils that are commonly associated with Hoccheim soils in the northeastern part of the association but also are in drainageways and narrow depressions.

Most of this association is used for dairy farming. The soils are well suited to all the crops commonly grown in the county. Common crops are oats, corn, alfalfa, and bromegrass for hay. The soils that are not cultivated are generally those that are somewhat poorly drained or poorly drained. They are wooded or in permanent pasture. Controlling erosion and maintaining fertility are the main concerns in managing cultivated areas.

Soils of this association are well suited to residential and industrial developments. Some small areas are used for peas, green beans, and other special crops.

5. Onaway-Solona Association

Deep, well-drained and somewhat poorly drained, nearly level to moderately steep soils that have a loamy subsoil; on glacial till plains

This association consists of nearly level to moderately steep soils on glacial till plains (fig. 5). It occupies about 6 percent of the county.

Onaway soils make up about 55 percent of this association; Solona soils, 29 percent; and minor soils, the remaining 16 percent.

Onaway soils are nearly level to moderately steep and are well drained. They have a surface layer of loam or sandy loam about 6 inches thick. The subsoil is brown to dark-brown fine sandy loam in the upper part and reddish-brown clay loam in the lower part. It is about 21 inches thick. The substratum is mainly reddish-brown loam.

Solona soils are nearly level to gently sloping and are somewhat poorly drained. These soils are in depressions and drainageways. They have a surface layer of loam or sandy loam about 9 inches thick over a loam or sandy loam subsurface layer about 6 inches thick. The subsoil is about 11 inches thick and is brown and reddish-brown loam and clay loam with strong-brown and light brownish-gray mottles. The substratum is reddish-brown loam with yellowish-red and light brownish-gray mottles.

Minor soils in this association are the Angelica soils in ponded depressions, and soils of the Menominee, Shawano, Manistee, and Sisson series, which occur throughout the association but primarily next to soils in adjacent associations.

Most of this association is cultivated and is used for general farming. Common crops are oats, corn, and alfalfa and bromegrass for hay. Uncultivated areas are in pasture or are wooded. If crops are to grow well, protection from runoff and erosion is needed on the steeper soils, and artificial drainage is needed on the wet soils.

6. Oshkosh-Allendale-Tedrow Association

Deep, well-drained to somewhat poorly drained, nearly level to steep soils that have a clayey and sandy subsoil; on glacial lake plains dissected by narrow V-shaped valleys

This association consists of soils of glacial lake plains in basins that have been influenced in places by recent

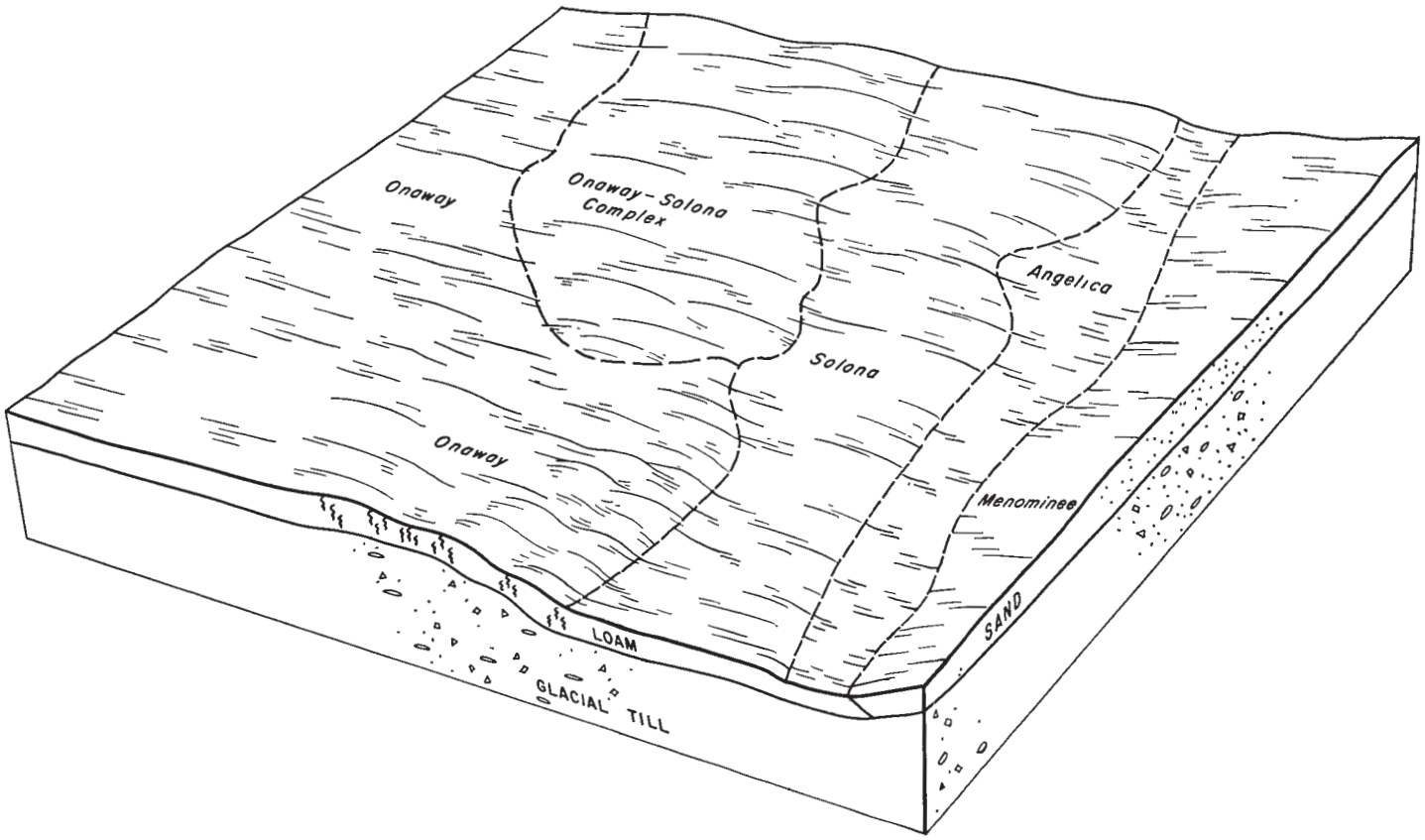

Figure 5.—Parent material and typical pattern of soils of association 5.

flooding and overflow (fig. 6). It occupies about 4 percent of the county.

Oshkosh soils make up about 30 percent of this association; Allendale soils, about 9 percent; Tedrow soils, about 8 percent; and minor soils, the remaining 53 percent.

Oshkosh soils are nearly level to steep and are well drained and moderately well drained. They have a surface layer of sandy loam, silt loam, or silty clay loam about 7 inches thick. The subsoil is dark reddish-gray and reddish-brown silty clay about 22 inches thick, and the substratum is silty clay.

Allendale and Tedrow soils are nearly level or very gently sloping and are somewhat poorly drained. Allendale soils have a surface layer of fine sandy loam to loamy fine sand about 8 inches thick and a subsurface layer of mottled fine sand about 7 inches thick. The subsoil is mottled, dark-brown to brown fine sand and loamy fine sand in the upper part and mottled, reddish-brown silty clay in the lower part. It is about 25 inches thick. The substratum is reddish-brown silty clay. The Tedrow soils have a surface layer of loamy fine sand about 7 inches thick. The subsoil and substratum are fine sand.

Minor soils in this association are of the Manawa, Poygan, Manistee, Wauseon, Sisson, Kibbie, and Bellevue series. They occur in a scattered pattern throughout the association.

Some acreage of this association is wooded; some is used for peas, beans, cabbage, and other specialty crops; and some is used for general farming. Farm crops commonly grown are oats, corn, and alfalfa and bromegrass for hay. Other areas of this association are now used for residential and industrial development.

7. Tedrow-Roscommon Association

Deep, somewhat poorly drained and poorly drained, nearly level soils that have a sandy subsoil; on glacial lakes and outwash plains.

This association consists of nearly level soils and soils in depressions on old glacial lake and outwash plains (fig. 4). It occupies about 3 percent of the county.

Tedrow soils make up about 50 percent of this association; Roscommon soils, 16 percent; and minor soils, the remaining 34 percent.

Tedrow and Roscommon soils formed in deep sands. They commonly have a surface layer of loamy fine sand. The Tedrow soils are somewhat poorly drained, and the water table is near the surface during wet periods. The Roscommon soils are poorly drained, and the water table is near the surface during much of the year. In places the Roscommon soils have a thin layer of muck on the surface.

Minor soils in the association are of the Shawano, Yahara, Keowns, Manistee, and Allendale series. These occur without pattern throughout the association.

The soils in this association are low in natural fertility and commonly are poorly suited to crops. Drainage is

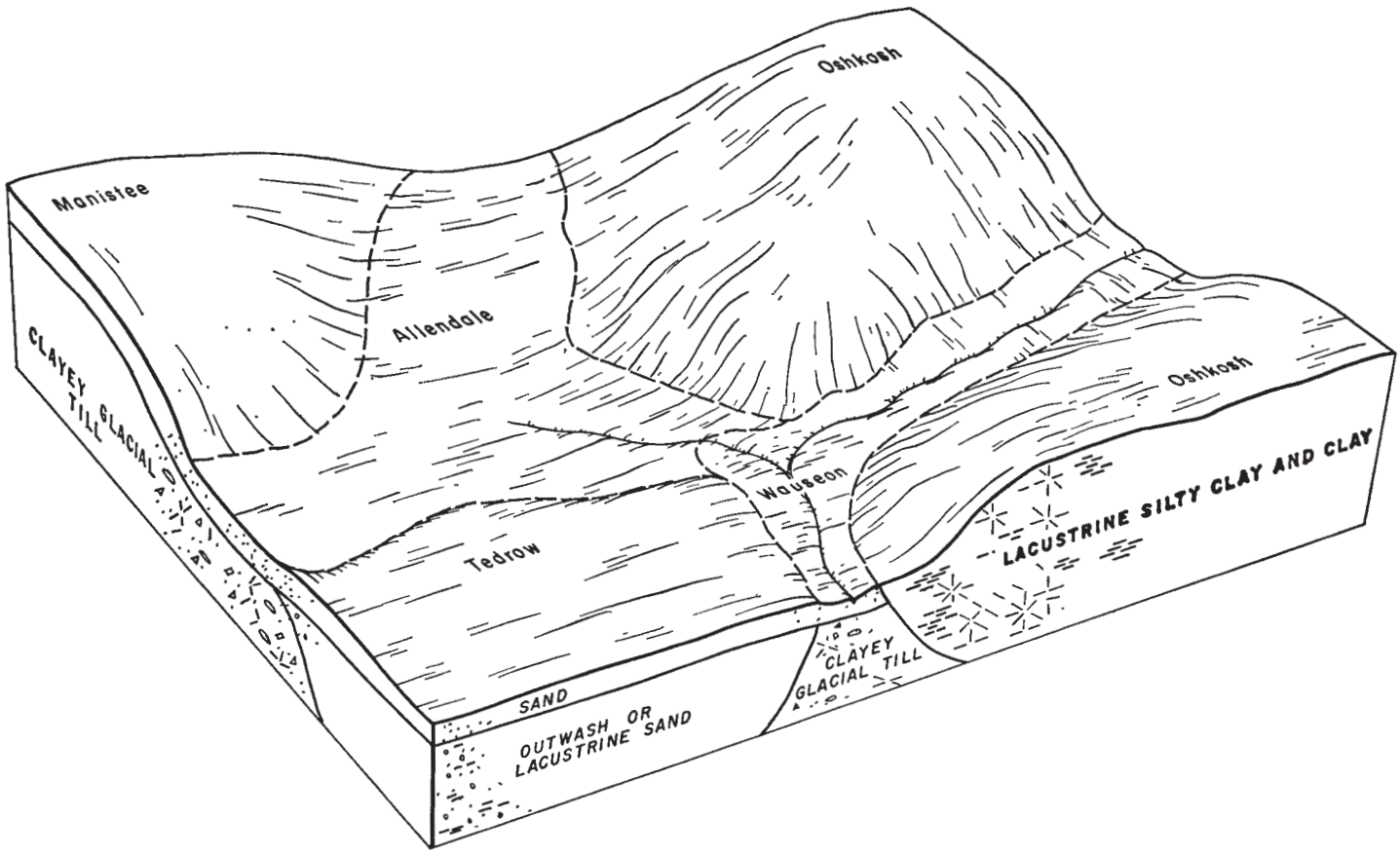

Figure 6.—Parent material and typical pattern of soils of association 6.

necessary, but in many places it is difficult to obtain good outlets. Much of this association is used for pasture or for low-quality woodlots.

The soils generally have severe limitations for homesites. The high water table restricts the operation of sewage disposal systems, and at times sewage effluent contaminates shallow wells. This association is suitable for wildlife habitat and for hunting and other outdoor recreation.

8. Namur-Summerville-Kolberg Association

Very shallow to moderately deep, nearly level to moderately steep soils that have a loamy and clayey subsoil; underlain by limestone bedrock; on glacial till plains

Bedrock has a strong influence on topography in this association (fig. 7). Most soils are nearly level to sloping. The association occupies about 3 percent of the county.

Namur soils make up about 30 percent of this association; Summerville soils, 20 percent; Kolberg soils, 11 percent; and minor soils, the remaining 39 percent.

Namur soils are nearly level to moderately steep. They are mostly well drained; but in places in depressions and areas of nearly level soils, they are poorly drained. The soils are only 5 to 12 inches deep over limestone bedrock, and in most places they are less than 7 inches deep. The surface layer is silt loam.

Summerville soils are nearly level to moderately steep and are well drained. They are 10 to 20 inches deep over bedrock. The surface layer is loam or silt loam about 7 inches thick, and the subsoil is brown to dark reddish-brown loam to heavy clay loam. Limestone bedrock is immediately below the subsoil.

The Kolberg soils are nearly level to sloping and are well drained. They are underlain by bedrock at a depth of 20 to 40 inches. The surface layer is silt loam about 7 inches thick, and the subsurface layer is silt loam about 6 inches thick. The upper part of the subsoil is a mixture of brown to dark-brown silt loam and reddish-brown silty clay loam. The lower part is reddish-brown, dark reddish-brown, and yellowish-red silty clay and silty clay loam.

Minor soils in this association are of the Bonduel and Ruse series. They are in depressions and along drainageways.

Most of this association is wooded or in permanent pasture. The deeper Kolberg soils are cultivated. Controlling erosion and maintaining good tilth are the main concerns in managing the cultivated areas.

9. Carbondale-Cathro-Marsh Association

Very poorly drained, nearly level organic soils and marshes

This association consists of low-lying soils on plains and in depressions. It occupies about 2 percent of the county.

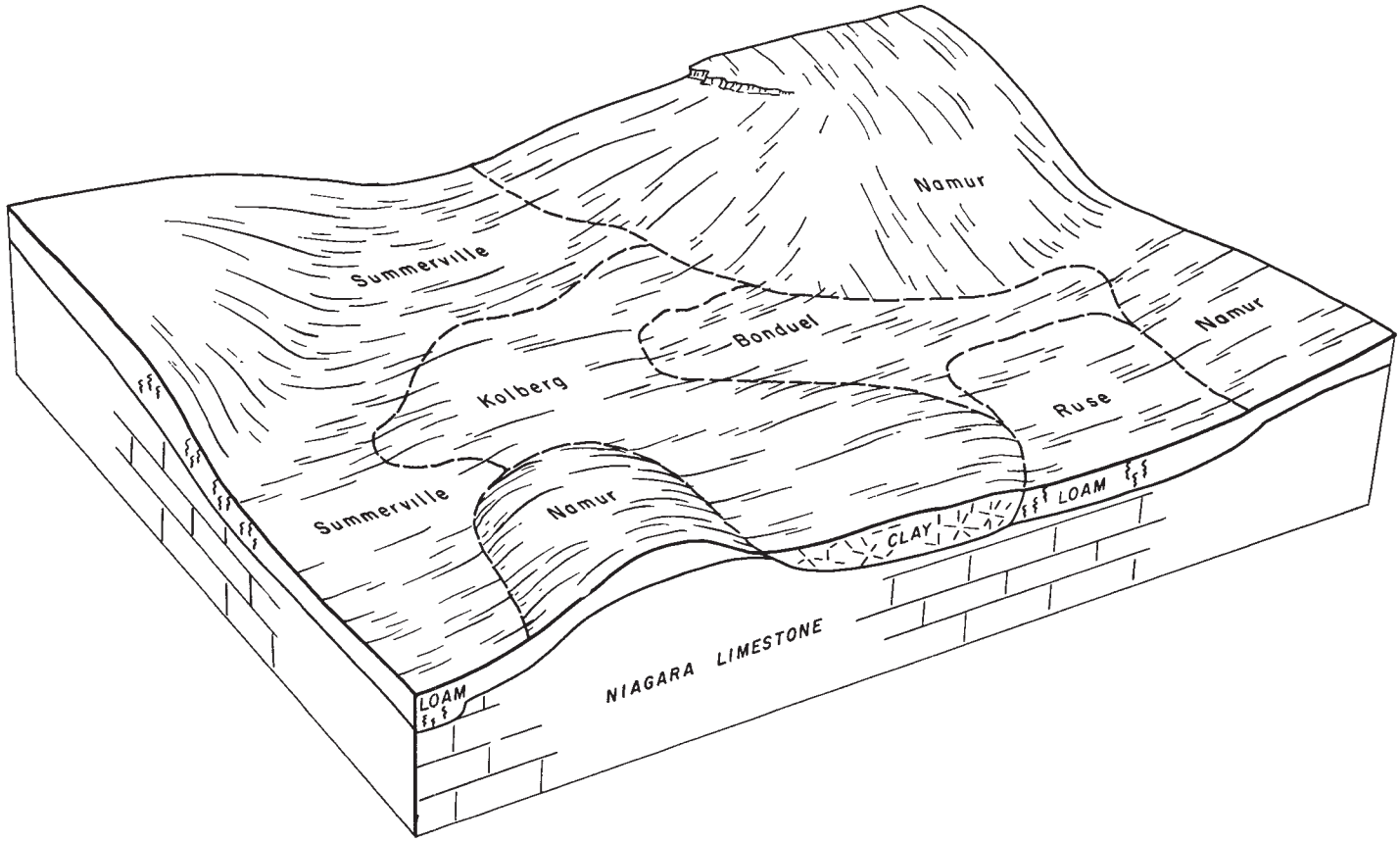

Figure 7.—Parent material and typical pattern of soils of association 8.

Carbondale soils make up about 52 percent of this association; Cathro soils, 24 percent; Marsh, 18 percent; and minor soils, the remaining 6 percent.

Carbondale soils are organic, and the organic material extends to a depth of more than 51 inches. Cathro soils are shallower than Carbondale soils and consist of 16 to 42 inches of organic material underlain by loamy mineral material. Marsh consists of low-lying areas that are periodically flooded and covered mainly with grasses and sedges.

Area of soils of the Markey series are in low-lying areas along Green Bay.

Drained organic soils in this association are moderately well suited to crops. In addition to drainage, however, controls are needed for maintaining the level of the water table so that the hazards of soil blowing and consolidation will be reduced. Most of these soils are in water-tolerant grasses, shrubs, and trees. The use of the soils for growing trees or as residential and recreational areas is severely limited.

10. Shawano-Tedrow-Roscommon Association

Deep, excessively drained to poorly drained, nearly level to steep soils that have a sandy subsoil; on glacial lake and outwash plains and ridges

This association consists of soils on lake plains, outwash plains, and stabilized dune ridges (fig. 8). These soils formed in deep sands. The association occupies about 2 percent of the county.

Shawano soils make up 50 percent of this association; Tedrow soils, 12 percent; Roscommon soils, 13 percent; and minor soils, the remaining 25 percent.

Shawano soils are excessively drained and are sloping to steep. They are on sandy dune ridges. These soils have a surface layer of loamy fine sand or fine sand. Tedrow soils are nearly level and are somewhat poorly drained. They have a surface layer of loamy fine sand.

Roscommon soils are nearly level and are in depressions. They are poorly drained. These soils have a thin surface layer of loamy fine sand. In some areas of Roscommon soils, a thin layer of muck is on the surface.

Minor soils in this association are soils of the Keown, Yahara, Poygan, Allendale, and Markey series and areas of Marsh. Most of the minor soils occur near adjoining associations.

The soils of this association generally are poorly suited to farming. If cultivated they are subject to soil blowing. In much of the acreage formerly used for crops, the soils have been so damaged by soil blowing that the areas have been abandoned.

These soils are better suited to trees than to crops or pasture. Cleared areas have been planted in conifers, mainly red pine, which grow well on these soils and help to control erosion.

Soils in this association are among the best in the county for recreation and community development. Sites for houses and other structures generally are good. Wooded areas provide aesthetic value and wildlife habitats.

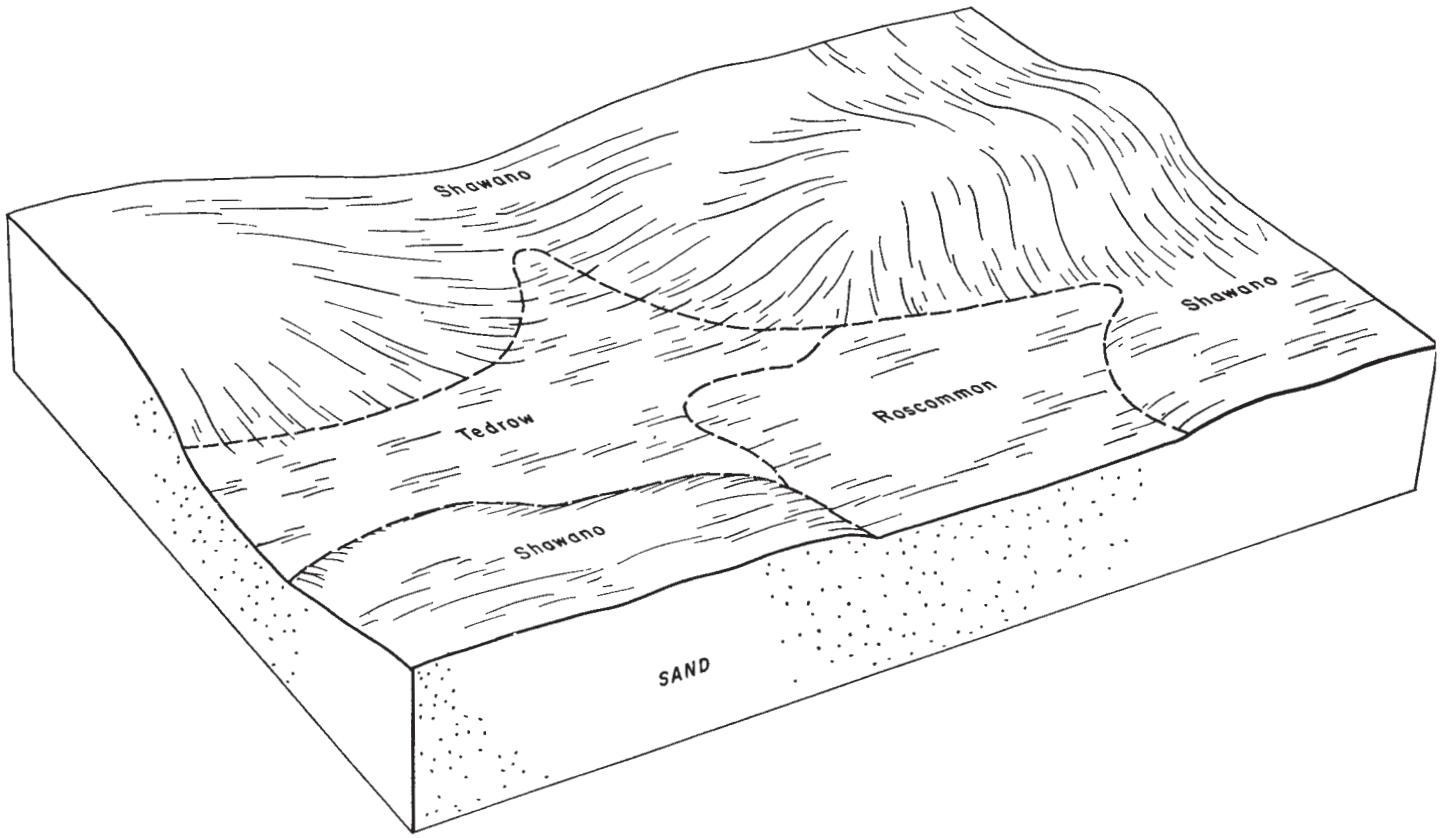

Figure 8.—**Parent material and typical pattern of soils of association 10.**

Descriptions of the Soils

This section describes the soil series and mapping units in Brown County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors and consistence given in the descriptions are those of a moist soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Alluvial land, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, woodland group, shrub and vine group, and wildlife group in which the mapping unit has been placed. The page for the description of each capability unit or other interpretative group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*7*).[1]

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Allendale Series

The Allendale series consists of deep, somewhat poorly drained soils on lacustrine plains. These soils formed in sand and in the underlying clayey lacustrine sediment or glacial till. Slopes range from 0 to 3 percent.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 8 inches thick. The subsurface layer, about 7 inches thick, is reddish-yellow and strong-brown fine sand mottled with yellowish red and light brownish gray. The subsoil is about 25 inches thick. It is dark-brown to brown fine sand mottled with reddish yellow in the upper part, brown loamy fine sand mottled with reddish yellow and gray in the middle part, and reddish-brown silty clay mottled with strong brown and reddish yellow in the lower part. The substratum is reddish-brown silty clay that extends to a depth of 60 inches.

Allendale soils have medium available water capacity. The sandy part of the profile is rapidly permeable, and the clayey lower part and the substratum is slowly permeable. In wet seasons water remains above the slowly permeable substratum. Reaction is neutral to moderately alkaline.

Representative profile of Allendale loamy fine sand, 0 to 3 percent slopes, in a hayfield (SW¼NW¼ sec. 10, T. 24 N., R. 20 E., 410 feet west and 165 feet south of highway railroad crossing):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, subangular blocky structure; very friable; many roots, neutral; clear, wavy boundary

A21—8 to 12 inches, reddish-yellow (7.5YR 6/6) fine sand; common, fine, faint, yellowish-red (5YR 5/6) and common, fine, prominent light, brownish-gray (10YR 6/2) mottles; weak, fine, subangular blocky structure; very friable; common roots, neutral; clear, wavy boundary

A22—12 to 15 inches, strong-brown (7.5YR 5/6) fine sand; common, fine, faint, yellowish-red (5YR 5/6) mottles and few, fine, prominent, light brownish-gray (10YR 6/2) mottles; loose, neutral; clear, wavy boundary.

B2ir—15 to 21 inches, dark-brown to brown (7.5YR 4/4) fine sand; few, fine, distinct, reddish-yellow (7.5YR 6/8) mottles; weak, medium, subangular blocky structure; very friable; neutral; clear, wavy boundary

I&IIB'1—21 to 26 inches, brown (7.5YR 5/4) loamy fine sand; few, fine, prominent, reddish-yellow (7.5YR 6/8) and common, fine, prominent, gray (N 5/0) mottles; weak, medium, subangular blocky structure; friable; neutral, abrupt, wavy boundary

IIB'2t—26 to 36 inches, reddish-brown (5YR 5/4) silty clay; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm, gray (N 5/0) coatings along root channels; thin patchy clay films; mildly alkaline; gradual, wavy boundary

IIB'3t—36 to 40 inches, reddish-brown (5YR 4/4) silty clay; few, fine and medium, distinct, strong-brown (7.5YR 5/6) and few, fine, prominent, reddish-yellow (7.5YR 6/8) mottles, moderate, medium, subangular blocky structure, firm; few, thin, patchy clay films; calcareous; clear, wavy boundary

IIC—40 to 60 inches, reddish-brown (5YR 4/4) silty clay; weak, medium, subangular blocky structure; firm; calcareous

The Ap or A1 horizon ranges from fine sandy loam to loamy fine sand In cultivated areas the Ap horizon has a hue of 10YR, a value of 3 to 5, and a chroma of 2 or 3 In undisturbed areas the A1 horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 1 to 3 Below the Ap or A1 horizon, the texture of the sandy part of the solum is fine sand or medium sand The sand extends to a depth between 18 and 36 inches The C horizon and the clayey part of the B horizon are dominantly silty clay, but range to silty clay loam or clay loam In places the C horizon contains thin layers of loamy fine sand, fine sand, very fine sand, or silt.

Allendale soils are commonly associated with Manistee and Wauseon soils They form a drainage sequence with well-drained Manistee and poorly drained Wauseon soils.

Allendale loamy fine sand, 0 to 3 percent slopes (AdA).—This soil is on lacustrine plains. It has the profile described as representative of the series.

[1] Italic numbers in parentheses refer to Literature Cited, p 117

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Allendale loamy fine sand, 0 to 3 percent slopes	3,000	0.9	Manistee fine sandy loam, 2 to 6 percent slopes	2,450	.8
Allendale fine sandy loam, 0 to 3 percent slopes	1,050	.3	Markey muck	1,050	.3
Alluvial land	3,950	1.2	Marsh	2,050	.6
Alluvial land, wet	3,500	1.0	Menominee loamy fine sand, 2 to 6 percent slopes	580	.2
Angelica silt loam	870	.2	Namur silt loam, 1 to 6 percent slopes	1,800	.5
Bellevue silt loam	4,600	1.3	Namur silt loam, 6 to 20 percent slopes	400	.1
Bellevue silty clay loam, mottled subsoil variant	1,550	.5	Namur silt loam, wet variant	700	.2
Bonduel loam, 0 to 3 percent slopes	750	2	Ogden muck	1,600	.5
Borrow pits	218	.1	Onaway sandy loam, 2 to 6 percent slopes	2,000	.6
Boyer loamy fine sand, 2 to 6 percent slopes	3,200	1.0	Onaway sandy loam, 6 to 12 percent slopes, eroded	260	.1
Boyer loamy fine sand, 6 to 12 percent slopes, eroded	810	.2	Onaway loam, 0 to 2 percent slopes	980	.3
Boyer loamy fine sand, 12 to 20 percent slopes, eroded	348	.1	Onaway loam, 2 to 6 percent slopes	6,400	1.9
Boyer loamy fine sand, 20 to 30 percent slopes	500	.2	Onaway loam, 12 to 20 percent slopes, eroded	437	.1
Briggsville silt loam, 2 to 6 percent slopes	1,650	.5	Onaway-Solona complex, 2 to 6 percent slopes	2,150	.6
Carbondale muck	5,500	1.6	Oshkosh sandy loam, 0 to 2 percent slopes	225	.1
Casco loam, 2 to 6 percent slopes	1,750	.5	Oshkosh sandy loam, 2 to 6 percent slopes	437	.1
Casco loam, 6 to 12 percent slopes, eroded	466	.1	Oshkosh silt loam, 0 to 2 percent slopes	9,700	2.9
Casco-Rodman complex, 12 to 35 percent slopes, eroded	424	1	Oshkosh silt loam, 2 to 6 percent slopes	20,000	6.0
Cathro muck	1,900	.6	Oshkosh silt loam, 6 to 12 percent slopes, eroded	970	3
Dresden sandy loam, 1 to 3 percent slopes	310	1	Oshkosh silt loam, 12 to 20 percent slopes, eroded	660	.2
Dresden silt loam, 1 to 3 percent slopes	405	1	Oshkosh silt loam, 20 to 30 percent slopes, eroded	600	.2
Dresden sandy loam, mottled subsoil variant, 0 to 2 percent slopes	181	1	Oshkosh silt loam, loamy substratum, 2 to 6 percent slopes	495	.1
Dresden silt loam, mottled subsoil variant, 1 to 3 percent slopes	860	.2	Oshkosh silty clay loam, 0 to 2 percent slopes	5,700	1.7
Dumps	281	1	Oshkosh silty clay loam, 2 to 6 percent slopes	1,950	.5
Fabius silt loam	800	.2	Pella silt loam	670	.2
Fill land	3,850	1.2	Poygan silty clay loam	9,100	2.7
Gravel pits	880	3	Quarries	270	.1
Hochheim loam, 2 to 6 percent slopes	2,900	.9	Roscommon loamy fine sand	4,000	1.2
Hochheim loam, 6 to 12 percent slopes, eroded	491	1	Rough broken land	740	.2
Keowns silt loam	3,400	1.0	Ruse silt loam	760	2
Kewaunee sandy loam, 2 to 6 percent slopes	1,050	3	Sebewa silt loam	690	2
Kewaunee sandy loam, 6 to 12 percent slopes, eroded	191	.1	Shawano fine sand, rolling	900	3
Kewaunee loam, gravelly substratum, 2 to 6 percent slopes	1,850	.6	Shawano fine sand, hilly	1,000	3
Kewaunee silt loam, 2 to 6 percent slopes	45,200	13.4	Shawano loamy fine sand, 2 to 6 percent slopes	8,200	2.4
Kewaunee silt loam, 2 to 6 percent slopes, eroded	23,000	6.9	Shawano loamy fine sand, 6 to 12 percent slopes	1,250	.4
Kewaunee silt loam, 6 to 12 percent slopes, eroded	13,750	4.1	Shullsburg silt loam, wet variant, 2 to 6 percent slopes	123	[1]
Kewaunee silt loam, 12 to 20 percent slopes, eroded	2,850	.9	Sisson fine sandy loam, 2 to 6 percent slopes	3,000	.9
Kewaunee silt loam, 20 to 30 percent slopes, eroded	2,000	6	Sisson fine sandy loam, 6 to 12 percent slopes, eroded	780	.2
Kewaunee soils, 6 to 12 percent slopes, severely eroded	860	3	Sisson fine sandy loam, 12 to 20 percent slopes, eroded	342	.1
Kewaunee soils, 12 to 20 percent slopes, severely eroded	960	.3	Sisson silt loam, 0 to 2 percent slopes	620	.2
Kewaunee soils, 20 to 30 percent slopes, severely eroded	350	1	Sisson silt loam, 2 to 6 percent slopes	2,600	.8
Kewaunee-Manawa complex, 2 to 6 percent slopes	8,600	2.5	Solona sandy loam, 1 to 3 percent slopes	346	.1
Kewaunee-Manawa complex, 2 to 6 percent slopes, eroded	780	.2	Solona loam, 1 to 3 percent slopes	5,000	1.5
Kewaunee-Sisson complex, 15 to 30 percent slopes, eroded	750	.2	Stony and rocky land	560	.2
Kibbie silt loam, 1 to 3 percent slopes	3,450	1.0	Summerville loam, 1 to 6 percent slopes	900	.3
Kolberg silt loam, 1 to 6 percent slopes	930	.3	Summerville loam, 6 to 20 percent slopes, eroded	211	.1
Kolberg silt loam, 6 to 12 percent slopes, eroded	193	.1	Summerville silt loam, clayey subsoil variant, 1 to 6 percent slopes	1,300	4
Lamartine silt loam, 0 to 3 percent slopes	3,500	1.0	Tedrow loamy fine sand, 0 to 3 percent slopes	9,100	2.7
Manawa sandy loam, 1 to 3 percent slopes	540	2	Wauseon fine sandy loam	1,800	5
Manawa silty clay loam, 1 to 3 percent slopes	25,200	7.5	Waymor sandy loam, 2 to 6 percent slopes	445	.1
Manistee loamy fine sand, 2 to 6 percent slopes	1,400	4	Waymor silt loam, 0 to 2 percent slopes	540	.2
Manistee loamy fine sand, 6 to 14 percent slopes, eroded	305	1	Waymor silt loam, 2 to 6 percent slopes	16,700	4.9
			Waymor silt loam, 6 to 12 percent slopes, eroded	6,300	1.9
			Waymor silt loam, 12 to 20 percent slopes, eroded	1,000	.3
			Waymor-Casco-Sisson complex, 3 to 12 percent slopes	670	.2
			Waymor-Casco-Sisson complex, 12 to 25 percent slopes	386	.1
			Yahara fine sandy loam, 0 to 3 percent slopes	2,000	.6
			Yahara silt loam, 0 to 3 percent slopes	2,000	.6
			Total	336,000	100.0

[1] Less than 0.05 percent

Included with this soil in mapping were small areas of Allendale soils that have a surface layer of fine sandy loam. Also included were a few areas of a Manistee soil that has slopes of 4 percent.

Natural fertility and the content of organic matter are low in this soil, and runoff is slow. The effective depth to which roots can penetrate is 40 inches or more. Wetness is the main limitation to use of this soil for crops. Surface drains and tile drains help to remove excess water where this soil is used for crops.

Drained areas of this soil are suited to most crops commonly grown in the county. Undrained areas are used mainly for permanent pasture or trees. Capability unit IIIw–6; woodland group 7; shrub and vine group C; wildlife group 5a.

Allendale fine sandy loam, 0 to 3 percent slopes (AeA).—This soil is on lacustrine plains. The surface layer is lighter colored and has a lower content of sand than that in the profile described as representative of the series.

Included with this soil in mapping were some areas where the surface layer is loam or loamy fine sand. Also included were areas of Wauseon soils.

Natural fertility and the content of organic matter are low in this soil, and runoff is slow. The effective depth to which roots can penetrate is 40 inches or more. Wetness is the main limitation to use of this soil for crops. Surface drains and tile drains help to remove excess water where this soil is farmed.

Drained areas of this soil are suited to most of the crops commonly grown in the county. Undrained areas are used mainly for permanent pasture or trees. Capability unit IIIw–6; woodland group 7; shrub and vine group C; wildlife group 5a.

Alluvial Land

Alluvial land (0 to 4 percent slopes) (Au) is a well-drained to somewhat poorly drained land type on bottom lands adjacent to well-defined, nondissected stream channels throughout the county. It consists of unconsolidated alluvium that generally is stratified and varies widely in texture. This land type is subject to frequent overflow, but not so frequent as Alluvial land, wet.

This land type is better suited to trees or pasture than to field crops. It can be used for field crops, however, if it is protected from overflow. Capability unit IIw–11; woodland group 1; shrub and vine group A; wildlife group 7.

Alluvial land, wet (0 to 2 percent slopes) (Aw) is poorly drained and very poorly drained mineral material that is adjacent to stream channels. It is subject to frequent flooding.

This land type is poorly suited to farming; but it can be used for trees, for wildlife habitat, and for limited grazing. Capability unit Vw–14; woodland group 9; shrub and vine group C; wildlife group 5b.

Angelica Series

The Angelica series consists of deep, poorly drained soils on glacial till plains, in depressions, and in drainageways. These soils formed in loamy, calcareous glacial till. Slopes are 0 to 2 percent.

In a representative profile the surface layer is very dark brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 27 inches, is grayish-brown loam with strong-brown mottles in the upper part; reddish-brown heavy loam with yellowish-red, grayish-brown, and brownish-yellow mottles in the middle part; and reddish-brown loam with yellowish-red and light brownish-gray mottles in the lower part. The substratum is reddish-brown loam with yellowish-red mottles. It extends to a depth of 60 inches and contains many fragments of limestone.

Angelica soils have high available water capacity and moderate permeability. Reaction is slightly acid or neutral.

Representative profile of Angelica silt loam in a cultivated field (NE¼NW¼ sec. 32, T. 25 N., R. 19 E., 600 feet west of field entrance):

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; firm, many roots; neutral; clear, irregular boundary.

B21g—8 to 13 inches, grayish-brown (10YR 5/2) loam; many, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable; many roots; neutral; clear, wavy boundary.

B22t—13 to 20 inches, reddish-brown (5YR 4/4) heavy loam; many, medium, prominent, yellowish-red (5YR 4/8) and grayish-brown (10YR 5/2) and many, medium, distinct, brownish-yellow (10YR 6/6) mottles; moderate, medium and fine, subangular blocky structure; firm, few roots; neutral, clear, wavy boundary.

B3—20 to 27 inches, reddish-brown (5YR 5/4 and 5YR 4/4) loam, many, coarse, prominent, yellowish-red (5YR 5/8) and few, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; firm; common, coarse, prominent, weathered limestone fragments of brownish yellow (10YR 6/6); mildly alkaline; clear, wavy boundary.

C—27 to 60 inches, reddish-brown (5YR 5/4) loam; common, coarse, prominent yellowish-red (5YR 5/8) mottles; massive; firm; calcareous.

The solum ranges from 15 to 30 inches in thickness, but it is commonly between 20 and 28 inches. In places in undisturbed areas black (10YR 2/1) organic matter up to 4 inches thick is on the surface. The A horizon generally is loam or silt loam. The B horizon has colors in hues of 5YR, 7.5YR, or 10YR; values of 4 to 6, and chromas of 2 to 6. The upper part of the B horizon is silt loam in some places. The reddish-brown matrix colors in the B horizon reflect the color of the material in which these soils formed. The C horizon has hues of 5YR or 7.5YR; values of 5 to 7, and chromas of 2 to 4. In most places the C horizon is loam, but in places it is gravelly loam or heavy sandy loam.

Angelica soils are commonly associated with Menominee, Solona, and Onaway soils. They have a finer texture and are wetter than the Menominee soils, and they are wetter than the somewhat poorly drained Solona soils and the well-drained Onaway soils.

Angelica silt loam (0 to 2 percent slopes) (Ax).—This soil is in drainageways and depressions in the glacial till plains. In areas that have not been cultivated, the surface layer is thinner and darker colored than the one in the profile described as representative of the series. Some areas have an accumulation of alluvium on the surface.

Included with this soil in mapping were areas of Solona soils that are better drained than this soil. Also included were small areas of Angelica soils that have slopes of 3 and 4 percent.

Natural fertility and the content of organic matter are medium in this soil. Runoff is slow to very slow. The ef-

fective depth to which roots can penetrate is 40 inches or more.

Wetness is the main limitation to use of this soil for crops. Drainage is required for row crops. Corn and oats grow well where drainage practices have been established. Capability unit IIw–1; woodland group 7; shrub and vine group C; wildlife group 5b.

Bellevue Series

The Bellevue series consists of soils that are deep and moderately well drained. These soils formed mainly in reddish-brown alluvium. They are subject to stream overflow. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is very dark grayish-brown and very dark brown silt loam about 18 inches thick. The subsoil extends to a depth of about 36 inches. The upper part is dark reddish-brown heavy silt loam with yellowish-red mottles. The middle part is dark reddish-brown loam with yellowish-red mottles, and the lower part is reddish-brown fine sandy loam with yellowish-red mottles. The substratum, to a depth of about 46 inches, is reddish-brown loam with yellowish-red mottles. Below this, to a depth of 60 inches, it is reddish-brown silty clay loam with yellowish-red and grayish-brown mottles.

Bellevue soils have a high available water capacity and moderately slow permeability. Reaction is neutral to moderately alkaline.

Representative profile of Bellevue silt loam in a pasture (T. 23 N., R. 20 E., Public Claim 38, about 2 miles southeast of De Pere on County Highway X, and 330 feet east of the highway at the East River bridge):

A11—0 to 13 inches, very dark grayish-brown (10YR 3/2) silt loam, dark brown (10YR 3/3) crushed; moderate, medium and fine, subangular blocky structure; friable; common roots; some reddish-brown (5YR 4/4) worm casts; moderately alkaline; clear, wavy boundary.

A12—13 to 18 inches, very dark grayish-brown (10YR 3/2) to very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) crushed; moderate, medium, angular blocky structure parting to strong, fine, angular and subangular blocky, firm; few roots; many reddish-brown (5YR 4/4) worm casts; mildly alkaline; clear, wavy boundary.

B1—18 to 22 inches, dark reddish-brown (5YR 3/4) heavy silt loam, reddish brown (5YR 4/4) crushed; few, fine, prominent, yellowish-red (5YR 4/8) mottles; moderate, medium, subangular blocky structure parting to moderate, fine, angular blocky; firm; few roots; many reddish-brown (5YR 4/4) worm casts; vesicular; some organic stains on vertical faces; mildly alkaline; clear, wavy boundary

B2—22 to 28 inches, dark reddish-brown (5YR 3/4) loam, reddish brown (5YR 4/4) crushed; common, fine, prominent, yellowish-red (5YR 4/8) mottles; moderate to strong, medium and fine, angular and subangular blocky structure; firm; vesicular, few roots; neutral; clear, wavy boundary.

B3—28 to 36 inches, reddish-brown (5YR 4/4) fine sandy loam; common, medium, prominent, yellowish-red (5YR 5/8) mottles; weak to moderate, medium, angular and subangular blocky structure, friable; neutral; clear, wavy boundary

C1—36 to 46 inches, reddish-brown (5YR 4/4) loam; many, medium, prominent, yellowish-red (5YR 5/8) mottles; weak, medium, subangular blocky structure; friable; slightly alkaline; clear, wavy boundary.

C2—46 to 60 inches, reddish-brown (5YR 4/4) silty clay loam; many, medium, prominent, yellowish-red (5YR 5/8) mottles throughout and common, medium, distinct, grayish-brown (10YR 5/2) mottles at a depth of 56 inches; massive; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness, but it is dominantly between 30 and 40 inches The A horizon has colors in hues of 7 5YR or 10YR, values of 2 or 3, and chromas of 2 to 4 Mottles are absent in places Layers of sand, 1 to 4 inches thick, occur at various depths, but generally are below a depth of 26 inches Thin patchy clay films and thin layers of gravel or mollusk shells are present in places

Bellevue soils are commonly associated with the mottled subsoil variants of the Bellevue series They have better drainage than these soils.

Bellevue silt loam (0 to 2 percent slopes) (Bc).—This soil is on flood plains.

Included with this soil in mapping were small areas of mottled subsoil variants of the Bellevue series and small areas of Alluvial land and Alluvial land, wet. Also included in some places were areas of a Bellevue soil that has a surface layer of silty clay loam.

Natural fertility and the content of organic matter are medium. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Overflow during spring runoff or following heavy rainfall is the main hazard to crops.

Where protected from overflow, this soil is well suited to all the crops commonly grown in the county. It is used mainly for permanent pasture. Capability unit IIw–11; woodland group 9; shrub and vine group A; wildlife group 7.

Bellevue Series, Mottled Subsoil Variant

The mottled subsoil variants of the Bellevue series are deep, somewhat poorly drained soils that are subject to stream overflow. They formed mainly in reddish-brown alluvium. Slopes range from 0 to 2 percent.

In a representative profile the surface layer is very dark grayish-brown silty clay loam about 12 inches thick. The subsoil extends to a depth of about 27 inches. It is dark reddish-brown heavy silty clay loam and has dark-gray and reddish-brown mottles. The substratum, to a depth of about 45 inches, is reddish-brown silty clay loam with dark-gray and yellowish-red mottles. Below this, to a depth of 60 inches, it is reddish-brown sandy clay loam with dark-gray and yellowish-red mottles.

These soils have a high available water capacity and moderately slow permeability. The content of organic matter is high. Reaction is neutral to moderately alkaline.

Representative profile of Bellevue silty clay loam, mottled subsoil variant, in a cultivated area (NW¼NE¼ sec. 35, T. 22 N., R. 19 E.):

A1—0 to 12 inches, very dark grayish-brown (10YR 3/2) silty clay loam; moderate, fine, subangular blocky structure; firm; many roots; mildly alkaline; gradual, irregular boundary.

B—12 to 27 inches, dark reddish-brown (5YR 3/3) heavy silty clay loam; common, fine, distinct, dark-gray (5YR 4/1) and common, fine, faint, reddish-brown (5YR 4/4) mottles; moderate, medium, angular blocky structure; firm; mildly alkaline; clear, wavy boundary

C1—27 to 38 inches, reddish-brown (5YR 4/3) heavy silty clay loam; few, medium, distinct, dark-gray (5YR 4/1) and yellowish-red (5YR 4/6) mottles, weak, medium, subangular blocky structure; sticky; neutral, gradual, irregular boundary.

C2—38 to 45 inches; reddish-brown (5YR 4/3) silty clay loam; common, medium, distinct, dark-gray (5YR 4/1) and yellowish-red (5YR 4/6) mottles; massive; sticky; neutral; clear, wavy boundary.

C3—45 to 60 inches, reddish-brown (5YR 4/3) sandy clay loam; common, medium, distinct, dark-gray (5YR 4/1) and yellowish-red (5YR 4/6) mottles; massive; sticky; neutral.

The solum generally ranges between 25 and 35 inches in thickness, but in places it is as little as 20 inches or as much as 40 inches. The A horizon has a hue of 10YR, a value of 2 or 3, and a chroma of 1 or 2. The B and C horizons have a hue of 7.5YR or 5YR, a value of 3 to 5, and a chroma of 3 to 6. The B horizon is heavy silty clay loam or silty clay. The C horizon is sandy clay loam, clay loam, or silty clay loam.

Mottled subsoil variants of the Bellevue series occur near areas of normal Bellevue soils They are wetter than the Bellevue soils.

Bellevue silty clay loam, mottled subsoil variant (0 to 2 percent slopes) (Bd).—This is the only variant from the normal Bellevue series mapped in the county. It is on flood plains. Included in mapping were small areas of normal Bellevue soils and areas of Alluvial land, wet.

Natural fertility is medium, and the content of organic matter is high. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow.

Stream overflow is the main limitation to use of this soil for crops. Most areas are in permanent pasture or are wooded. Areas that have been cleared are used mainly for pasture. Capability unit IIw–11; woodland group 9; shrub and vine group C; wildlife group 5a.

Bonduel Series

The Bonduel series consists of moderately deep, somewhat poorly drained soils on glacial till plains. These soils formed mainly in calcareous till over limestone bedrock. The underlying bedrock has a strong influence on the topography where these soils occur. Slopes range from 0 to 3 percent.

In a representative profile the surface layer is very dark grayish-brown loam about 9 inches thick. The subsoil extends to a depth of about 24 inches. The upper part is brown to dark-brown loam mottled with yellowish red, yellowish brown, and grayish brown. The lower part is dark yellowish-brown sandy clay loam mottled with yellowish brown and grayish brown. The substratum, to a depth of 30 inches, is light yellowish-brown loam mottled with brownish yellow. Beneath this is limestone bedrock.

Bonduel soils have a low available water capacity and moderate permeability. Reaction is neutral to moderately alkaline.

Representative profile of Bonduel loam, 0 to 2 percent slopes, in a cultivated area (NE¼NW¼ sec. 18, T. 24 N., R. 22 E., 100 feet south and 50 feet east of fence corner):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, subangular blocky structure parting to moderate, fine, granular, very friable; many roots; mildly alkaline; abrupt, wavy boundary.

B1—9 to 16 inches, brown to dark-brown (10YR 4/3) loam; few, fine, prominent, yellowish-red (5YR 4/6) and many, medium, prominent, yellowish-brown (10YR 5/8) mottles; common, medium, faint, grayish-brown (10YR 5/2) mottles; moderate, fine and medium, subangular blocky structure; very friable; neutral; gradual, wavy boundary.

B2t—16 to 24 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; common, medium, prominent, yellowish-brown (10YR 5/8) and few, medium, distinct, grayish-brown (10YR 5/2) mottles; moderate, fine and medium, subangular blocky structure; friable; thin patchy clay films on peds; a few pebbles and pockets of sandy loam; neutral; clear, wavy boundary.

C—24 to 30 inches, light yellowish-brown (10YR 6/4) loam; few, fine, distinct, brownish-yellow (10YR 6/6) mottles; weak, medium, subangular blocky structure; friable; pebbles up to 20 millimeters in diameter and few flagstone fragments up to 14 inches; yellow (10YR 7/6) weathered limestone common; calcareous.

IIR—30 to 60 inches, limestone bedrock.

The solum ranges from 20 to 34 inches in thickness, and depth to bedrock is 20 to 40 inches. The C horizon is absent in some areas.

Bonduel soils occur near Kolberg and Namur soils. They have a lower clay content throughout the profile than the Kolberg soils and are deeper over bedrock than the Namur soils.

Bonduel loam, 0 to 3 percent slopes (BnA).—This soil is on glacial till plains. It is underlain by bedrock.

Included with this soil in mapping were areas of a Bonduel soil that has slopes of 4 to 6 percent.

Natural fertility and organic-matter content in this soil are medium. Runoff is slow. The effective depth to which roots can penetrate is 20 to 40 inches.

Wetness is the main limitation to use of this soil for crops, but surface drains are effective in removing excess water. This soil is suited to most of the commonly grown crops if drainage is provided. Most of the acreage is used for field crops or pasture. Capability unit IIw–5; woodland group 7; shrub and vine group C; wildlife group 5a.

Borrow Pits

Borrow pits (Bp) are areas 2 to 20 or more acres in size from which soil material has been removed for use as road fill.

Soil material on the floor of Borrow pits ranges from fine sand to silty clay or clay in texture. Some areas of Borrow pits are planted to hay crops, but this land type is better suited to recreational uses or as wildlife habitat. Not placed in a capability unit, woodland group, or shrub and vine group; wildlife group 8.

Boyer Series

The Boyer series consists of well-drained soils on outwash plains and morainic ridges. These soils are moderately deep to sand or sand and gravel. They formed in stratified fine and medium sand or sand and fine gravel. Slopes range from 2 to 30 percent.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 6 inches thick. The subsurface layer is yellowish-brown fine sand about 12 inches thick. The subsoil, extending to a depth of about 35 inches, is brown fine sandy loam in the upper part and reddish-brown heavy fine sandy loam in the lower part. The substratum, to a depth of 60 inches, is light yellowish-brown fine and medium sand.

Boyer soils have low available water capacity and moderately rapid permeability. Reaction is neutral to medium acid.

Representative profile of Boyer loamy fine sand, 6 to 12 percent slopes, eroded (SW¼NW¼ sec. 36, T. 24 N., R. 19 E., 300 feet south of farmstead on south bank of sand and gravel pit):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, subangular blocky structure parting to single grain; very friable; common roots; slightly acid; abrupt, wavy boundary.

A2—6 to 18 inches, yellowish-brown (10YR 5/4) fine sand; weak; medium, subangular blocky structure parting to single grain; very friable; common roots to a depth of 14 inches; less than 2 percent gravel that is less than 5 millimeters in diameter; slightly acid; abrupt, wavy boundary.

B21t—18 to 27 inches, brown (7.5YR 5/4) fine sandy loam; weak, coarse, subangular blocky structure; friable; thin patchy clay films on peds and bridging sand grains; isolated blotches of yellowish brown (10YR 5/4) throughout upper part; medium acid; clear, wavy boundary

B22t—27 to 35 inches, reddish-brown (5YR 4/4) heavy fine sandy loam; weak, coarse, subangular blocky structure; firm, thin patchy clay films on peds and bridging sand grains; medium acid; clear, irregular boundary

C—35 to 60 inches, light yellowish-brown (10YR 6/4) fine and medium sand; single grain; loose; strong-brown (7.5YR 5/6) bands less than ½ inch thick make up less than 10 percent of horizon; slightly acid.

The solum ranges from 24 to 40 inches in thickness. The Ap horizon is dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), or brown (10YR 5/3). Texture of this horizon ranges from loamy fine sand to fine sandy loam. In places the A2 horizon is brown (10YR 5/3). The B horizon is dark-brown (7.5YR 4/4), brown (7.5YR 5/4), or reddish-brown (5YR 4/4) sandy loam to light sandy clay loam. In places the lower part of the B22t horizon consists of layers of heavy fine sandy loam, ½ inch to 2 inches thick, that are separated by layers of yellowish-brown fine sand. The C horizon generally is stratified fine and medium sand, but it contains layers of fine gravel and coarse sand in some places.

Boyer soils are commonly associated with Sisson and Casco soils. Their Bt horizon has a lower content of clay and a higher content of sand than that in Sisson and Casco soils. Boyer soils also differ from Sisson soils in that they formed in outwash sand rather than in lacustrine silt and sand.

Boyer loamy fine sand, 2 to 6 percent slopes (BrB).—This soil occupies small areas on sandy outwash plains. The surface layer is thicker and, in places, is darker colored; but the profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping were small areas of sloping Boyer soils and small areas of Manistee and Shawano soils. Also included were small areas of Boyer soils that have a fine sandy loam surface layer or are eroded.

Natural fertility and organic-matter content are low in this soil, and runoff is slow. The soil is susceptible to soil blowing if planted to row crops.

Supplemental irrigation and other good management practices are needed to grow crops on this soil. In places this soil is used for corn, small grain, and hay. Much of the acreage is wooded or is in permanent pasture. Capability unit IIIs–4; woodland group 4; shrub and vine group B; wildlife group 3.

Boyer loamy fine sand, 6 to 12 percent slopes, eroded (BrC2).—This soil occupies small areas on sandy outwash plains. It has the profile described as representative for the series.

Included with this soil in mapping were a few areas of gently sloping Boyer soils, areas of moderately steep Boyer soils, and a limited acreage of Manistee and Shawano soils. Also included were small areas of Boyer soils that have a fine sandy loam surface layer or are only slightly eroded.

Natural fertility and organic-matter content are low in this soil, and runoff is slow.

The hazard of further erosion is the main limitation to use of this soil for crops. Supplemental irrigation and control of erosion are needed if this soil is used for field crops. Most of the acreage is wooded or is in permanent pasture. Capability unit IIIe–7; woodland group 4; shrub and vine group B; wildlife group 3.

Boyer loamy fine sand, 12 to 20 percent slopes, eroded (BrD2).—This soil is on sandy outwash plains. In most places slopes are less than 200 feet long. The surface layer is thinner and in places is lighter colored than that in the profile described as representative of the series.

Included with this soil in mapping were a few small areas of sloping Boyer soils, of steep Boyer soils, and a limited acreage of Manistee and Shawano soils. Also included were small areas of Boyer soils that are only slightly eroded or that have less sand in the surface layer than is typical for this soil.

Natural fertility and organic-matter content are low in this soil. Runoff is medium, and the hazard of further erosion is severe.

Supplemental irrigation and control of erosion are needed if this soil is used for crops. Much of the soil is wooded or is in permanent pasture. Capability unit IVe–7; woodland group 4; shrub and vine group B; wildlife group 3.

Boyer loamy fine sand, 20 to 30 percent slopes (BrE).—This soil is on outwash ridges. Slopes are less than 200 feet long. The surface layer and the subsoil are thinner than those in the profile described as representative of the series.

Included with this soil in mapping were small areas of moderately steep Boyer soils, of very steep Boyer soils, and of Manistee and Shawano soils. Areas of Boyer soils that have less sand in the surface layer were also included.

Natural fertility and organic-matter content are low in this soil. Runoff is medium, and the hazard of erosion is severe.

This soil is better suited to trees than to field crops or pasture. Most of the acreage is wooded or in permanent pasture. Capability unit VIe–7; woodland group 4; shrub and vine group B; wildlife group 3.

Briggsville Series

The Briggsville series consists of deep, well-drained soils on lacustrine plains. These soils formed in a thin silt mantle and underlying calcareous lacustrine silt and clay. Slopes range from 2 to 6 percent.

In a representative profile the surface layer is brown to dark-brown silt loam about 7 inches thick. The subsoil extends to a depth of about 26 inches. It is reddish-brown heavy silty clay loam. The substratum, to a depth of 60 inches, consists of layers of reddish-brown silty clay loam and silt.

Briggsville soils have high available water capacity and moderately slow permeability. Reaction is medium acid.

Representative profile of Briggsville silt loam, 2 to 6 percent slopes, in a cultivated field (NE¼NW¼ sec. 19, T. 24 N., R. 20 E., 410 feet west southwest of the intersection of County Highway J and a town road and 100 feet north of County Highway J):

Ap—0 to 7 inches, brown to dark-brown (7.5YR 4/2) silt loam; weak, medium, subangular blocky structure parting to moderate, fine, subangular blocky; very friable; many roots; remnant of weak, thin, platy A2 horizon, neutral; abrupt, wavy boundary.

B1t—7 to 10 inches, reddish-brown (5YR 4/3) silty clay loam; moderate, medium and fine, subangular blocky structure; firm; many roots; slightly acid; abrupt, irregular boundary

B21t—10 to 13 inches, reddish-brown (5YR 4/3) heavy silty clay loam; moderate, medium, subangular blocky structure; very firm; common roots; thin patchy clay films on peds; medium acid; abrupt, irregular boundary

B22t—13 to 22 inches; reddish-brown (5YR 4/3) heavy silty clay; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; very firm; thin patchy clay films on peds; medium acid; clear, irregular boundary

B3—22 to 26 inches, reddish-brown (5YR 5/4) heavy silty clay loam; weak, medium, prismatic structure parting to moderate, medium and coarse, subangular blocky; firm; slightly acid; clear, irregular boundary

C—26 to 60 inches; layered reddish-brown (5YR 4/3) silty clay loam and reddish-brown (5YR 4/4) silt; weak, medium, platy structure; firm; calcareous

The solum ranges from 24 to 40 inches in thickness, but it is commonly 24 to 30 inches. Undisturbed soils have an A2 horizon of light grayish brown (10YR 6/2) or pale brown (10YR 6/3) The B horizon has hues of 7.5YR or 5YR, values of 4 or 5, and chromas of 3 or 4. Texture ranges from silty clay loam to silty clay In places thin strata of fine sand occur in the solum The C horizon is dominantly silty clay loam, but in places it contains thin layers of silt or very fine sand It ranges from slightly calcareous to strongly calcareous.

Briggsville soils are near Oshkosh and Kibbie soils They have less clay in the B horizon than the Oshkosh soils and are better drained than the Kibbie soils

Briggsville silt loam, 2 to 6 percent slopes (BtB).—This soil is the only Briggsville soil mapped in the county. It is on lacustrine plains.

Included with this soil in mapping were small areas of a Briggsville soil that is eroded. Also included were long narrow areas of sloping Briggsville soils.

Natural fertility and the content of organic matter are medium. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Erosion is the main hazard on this soil.

Where this soil is cultivated intensively, erosion-control practices will decrease soil loss. This soil is suited to most of the field crops, hay crops, and pasture plants commonly grown in the county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Carbondale Series

The Carbondale series consists of deep, very poorly drained soils in shallow glacial lake basins and depressions in stream valleys. These soils formed in organic material derived from decayed water-tolerant grasses, shrubs, and reeds. The deposit of organic matter is more than 51 inches thick.

In a representative profile the surface layer is black muck about 32 inches thick. The next layer is very dark brown mucky peat about 13 inches thick. Below this, to a depth of 60 inches, is very dark brown muck.

Carbondale soils have very high available water capacity, moderately rapid permeability, and low natural fertility. Reaction is medium acid to neutral. Undrained areas are used for pasture or marsh grass, or are left for wildlife habitat. Drained areas are used for corn and truck crops. The soils are poorly suited to most engineering uses.

Representative profile of an undisturbed area of Carbondale muck, 0 to 2 percent slopes (NW¼SW¼, sec. 29, T. 23 N., R. 22 E., 1,650 feet north and 50 feet east of southwest section corner):

Oa1—0 to 5 inches, black (10YR 2/1) sapric material, black (10YR 2/1) rubbed or pressed; about 10 percent fibers, less than 5 percent rubbed; moderate, fine, granular structure; very friable; sodium pyrophosphate test shows pale brown (10YR 6/3); dominantly herbaceous fibers; neutral; abrupt, smooth boundary.

Oa2—5 to 16 inches, black (10YR 2/1) sapric material, black (10YR 2/1) pressed and dark reddish brown (5YR 2/2) rubbed; about 30 percent fibers, less than 10 percent rubbed, weak, medium, subangular blocky structure parting to moderate, fine, granular; very friable, sodium pyrophosphate test shows light yellowish brown (10YR 6/4); dominantly herbaceous fibers and a few woody fragments 5 to 15 millimeters in diameter; slightly acid; clear, smooth boundary

Oa3—16 to 32 inches, black (10YR 2/1) sapric material, black (10YR 2/1) rubbed or pressed, about 25 percent fibers, less than 5 percent rubbed; weak, coarse, subangular blocky structure parting to moderate, fine, granular; very friable; sodium pyrophosphate test shows yellowish brown (10YR 5/4); dominantly herbaceous fibers; slightly acid, abrupt, smooth boundary.

Oe—32 to 45 inches, very dark brown (10YR 2/2) hemic material, very dark brown (10YR 2/2) rubbed or pressed; about 55 percent fibers, about 15 percent rubbed; moderate, fine, granular structure; very friable; sodium pyrophosphate test shows very pale brown (10YR 7/3); dominantly herbaceous fibers; slightly acid; abrupt, smooth boundary

Oa4—45 to 60 inches, very dark brown (10YR 2/2) sapric material, very dark brown (10YR 2/2) rubbed or pressed, about 20 percent fibers, less than 5 percent rubbed; massive, nonsticky, sodium pyrophosphate test shows very pale brown (10YR 7/3); dominantly herbaceous fibers; medium acid.

The range in characteristics is generally in the degree of decomposition and color of the organic material Thin layers of fibric, and less commonly of limnic (coprogenous) material, are in the second and third tiers in some areas. Wood fragments as large as 2 inches in diameter also are in these soils in places Reaction in the subsurface tiers ranges from slightly acid to neutral The organic deposits vary in thickness, but they generally are less than 6 feet thick

Carbondale soils are near the Markey, Ogden, and Cathro soils; but they formed in deeper organic deposits than those soils

Carbondale muck (0 to 2 percent slopes) (Ca).—This is the only Carbondale soil mapped in the county. It is in flat, marshy areas in old glacial lake basins and along stream valleys.

Included with this soil in mapping were small areas of Markey, Ogden, Cathro, and other organic soils that are shallower to mineral material than this soil. Also in-

cluded were small areas of gently sloping Carbondale soils.

The content of phosphorus and potash is generally low in this soil. Many areas are ponded, and the water table is at or near the surface in some seasons. Drained areas are subject to soil blowing, and they burn readily. The frost hazard is only moderate because of the influence of Lake Michigan. Properties are unfavorable for most engineering uses. The high water table and low bearing capacity severely limit use of this soil for residential development. Drained areas are suited to crops that do not require a long growing season. Capability unit IIIw-9; woodland group 10; shrub and vine group C; wildlife group 6.

Casco Series

The Casco series consists of well-drained soils on outwash plains and morainic ridges. The soils are shallow to sand and gravel. They formed in a thin loamy mantle and the underlying outwash sand and gravel. Slopes are 2 to 12 percent.

In a representative profile the surface layer is dark grayish-brown loam about 6 inches thick. The subsurface layer is dark yellowish-brown loam about 3 inches thick. The subsoil, which extends to a depth of about 19 inches, is reddish-brown sandy clay loam in the upper part and reddish-brown and yellowish-brown gravelly sandy loam in the lower part. The substratum, to a depth of 60 inches, is strong-brown sand and gravel.

Available water capacity is low. Permeability is moderate above the substratum and rapid or very rapid in the substratum. Reaction is mildly alkaline.

Representative profile of Casco loam, 2 to 6 percent slopes, in a cultivated area (SE¼NE¼ sec. 25, T. 21 N., R. 21 E., about 1,000 yards north and 10 yards west of section corner):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam; moderate, fine and medium, granular structure; very friable; many roots, mildly alkaline; abrupt, smooth boundary.

A2—6 to 9 inches, dark yellowish-brown (10YR 4/4) loam; moderate, thin, platy structure; very friable; many roots; mildly alkaline; clear, wavy boundary

B2t—9 to 15 inches, reddish-brown (5YR 4/4) sandy clay loam, moderate, medium, subangular blocky structure; firm; thin patchy clay films on peds, mildly alkaline; clear, wavy boundary

IIB3—15 to 19 inches, reddish-brown (5YR 4/3) and yellowish-brown (10YR 5/6) gravelly sandy loam; weak, coarse, subangular blocky structure; very friable; clay bridging between sand grains; mildly alkaline; clear, wavy boundary

IIC—19 to 60 inches, strong-brown (7.5YR 5/6) sand and gravel; single grain; loose; calcareous

The solum ranges from 10 to 24 inches in thickness. In undisturbed areas the A1 horizon generally is thin and dark colored. The Ap horizon ranges in color from dark grayish brown (10YR 4/2) to brown (10YR 5/3). The B2t horizon has a hue of 10YR, 7.5YR, or 5YR; a value of 4 or 5; and a chroma of 3 or 4. It is sandy clay loam, clay loam, or heavy loam that is 18 to 35 percent clay. In some places 15 to 25 percent of the solum is glacial pebbles. In other places glacial pebbles are lacking. The IIC horizon consists of strata of poorly sorted to well-sorted calcareous sand and gravel that contains varying amounts of carbonate rock.

Casco soils are near Dresden, Dresden mottled subsoil variant, and Boyer soils. Their solum is thinner and contains less sand than the solum of the Boyer soils. The Casco soils are better drained and have a thinner solum than mottled subsoil variants of the Dresden series, and they have a thinner solum than the Dresden soils.

Casco loam, 2 to 6 percent slopes (CcB).—This soil is on outwash plains. It has the profile described as representative of the series (fig. 9).

Included with this soil in mapping were small cultivated areas of Casco soil that are moderately eroded and have a surface layer that is lighter colored than the one in this soil.

Natural fertility in this soil is medium, content of organic matter is low, and the effective depth to which roots penetrate ranges from 12 to 24 inches. Runoff is medium. Erosion is the main hazard when the soil is cultivated.

This soil is well suited to shallow-rooted crops and is fairly well suited to deep-rooted crops. Capability unit IIIe-3; woodland group 5; shrub and vine group B; wildlife group 3.

Casco loam, 6 to 12 percent slopes, eroded (CcC2).—This soil is on morainic ridges and knolls. It is shallower to sand and gravel than the soil described as representative of the series. Some of the reddish-brown subsoil has been mixed with the plow layer, and the plow layer is now lighter in color than in the representative profile.

Included with this soil in mapping were small areas of Dresden sandy loam, moderately eroded. Also included were numerous areas of a slightly eroded Casco loam in wooded and permanent pasture areas.

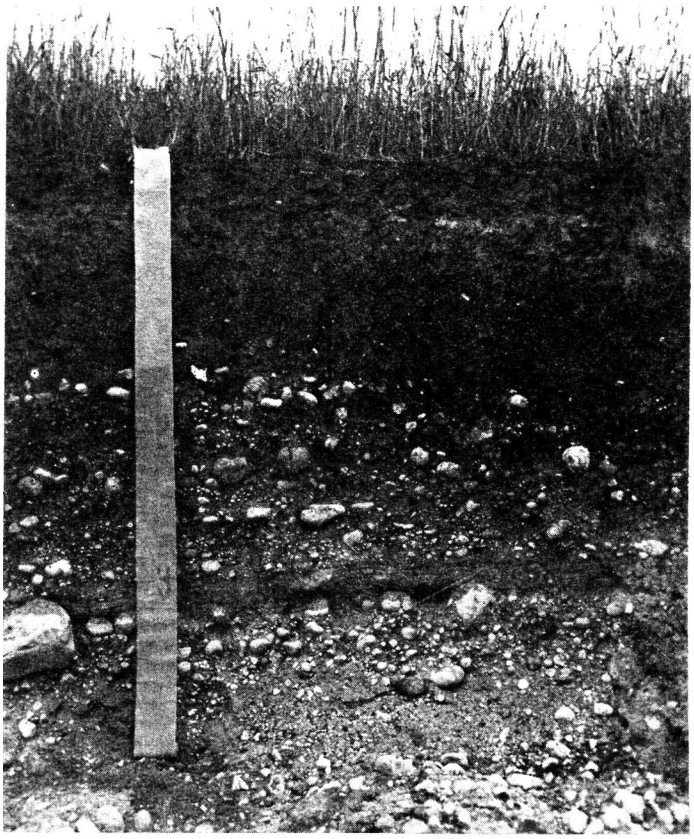

Figure 9.—**Typical profile of a Casco soil. Casco soils are good sources of sand and gravel.**

Natural fertility in this soil is medium, the content of organic matter is low, and the effective depth to which roots can penetrate ranges from 12 to 16 inches. Because of the limited available water capacity, droughtiness is a hazard to crops during dry periods. Runoff is medium and further erosion is a serious hazard. Erosion-control practices are beneficial where this soil is cultivated.

This soil is fairly well suited to crops commonly grown in the county and to pasture and hay plants. Capability unit IVe–3; woodland group 5; shrub and vine group B; wildlife group 3.

Casco-Rodman complex, 12 to 35 percent slopes, eroded (CdE2).—Soils in this complex are on the sides and crests of morainic ridges. About 40 percent is Casco soils; about 35 percent is Rodman soils; and the remaining 25 percent is minor soils of the Dresden and Fabius series and soils of the Dresden series, mottled subsoil variant. The Rodman soils are shallower to sand and gravel than the Casco soils, and they occur on the steeper areas of the complex. In some of steep soils areas, the Rodman soils are dominant. Runoff is medium rapid to rapid.

The surface layer is mainly loam; but some areas of silt loam, gravelly loam, and sandy loam were included in mapping.

Further erosion is the main hazard to use of these soils for crops, but droughtiness caused by the low available water capacity is also a hazard. Most of the acreage is wooded or is in grass. These soils are suited to pasture or trees. Capability unit VIe–3; woodland group 5; shrub and vine group B; wildlife group 3.

Cathro Series

The Cathro series consists of very poorly drained organic soils that are moderately deep to loamy mineral material. These soils are in shallow glacial lake basins and other depressions.

In a representative profile the surface layer is black muck about 14 inches thick. The next layer is black mucky peat about 9 inches thick. The third layer, which extends to a depth of 26 inches, is black sedimentary peat that has a gelatinous appearance. The substratum, to a depth of 34 inches, is gray silty clay loam with strong-brown mottles. Below this, the substratum, to a depth of 60 inches, is brown loam with strong-brown mottles.

Available water capacity in these soils is very high. Permeability is moderately rapid in the organic horizons and moderate in the mineral substratum. Reaction is slightly acid to mildly alkaline.

Representative profile of Cathro muck, 0 to 2 percent slopes, in a cultivated area (NW¼SE¼ sec. 22, T. 24 N., R. 19 E., 1,320 yards south and 715 yards west of northeast section corner):

Oa—0 to 14 inches, black (10YR 2/1) sapric material, undisturbed or rubbed; 10 percent fibers undisturbed, 2 percent rubbed; weak, fine, subangular blocky structure parting to weak, fine, granular; very friable; sodium pyrophosphate test shows dark grayish brown (10YR 4/2); herbaceous fibers; mildly alkaline; abrupt, wavy boundary

Oe—14 to 23 inches, black (10YR 2/1) hemic material undisturbed, dark reddish-brown (5YR 2/2) rubbed; 60 percent fibers undisturbed, and 35 percent rubbed; sodium pyrophosphate test shows brown (10YR 5/3); herbaceous fibers; abrupt, wavy boundary.

Lco—23 to 26 inches, black (5Y 2/1) coprogenous earth undisturbed or rubbed; less than 10 percent fibers; gelatinous parting to weak, medium, platy structure; nonsticky when wet; slightly acid; abrupt, wavy boundary.

IIC1—26 to 34 inches, gray (10YR 5/1) silty clay loam; many, fine, prominent, strong-brown (7.5YR 5/8) mottles; massive; firm; slightly acid; gradual, irregular boundary.

IIC2—34 to 60 inches, brown (7.5YR 5/2) loam; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; massive; some lenses of silt and fine sand; neutral

Organic material ranges from 16 to 42 inches in thickness, but it is dominantly between 20 and 40 inches thick. The degree of decompostion of the material varies. The Oa layer is highly decomposed; the underlying organic layer is less decomposed The Oa layer is commonly very dark gray (10YR 3/1) or black (10YR 2/1), primarily because of oxidation and humification. The Oe layer has a hue of 10YR, 7.5YR, or 5YR; a value of 2 to 4; and a chroma of 1 or 2. The layer of coprogenous earth is absent in many places. The substratum is dominantly sandy loam, loam, or silt loam; but it contains thin layers of silt, fine sand, and silty clay loam

Cathro soils are near the Carbondale and Ogden soils, but they lack the deep organic deposits of Carbondale soils and the moderately deep clayey substratum of Ogden soils.

Cathro muck (0 to 2 percent slopes) (Cm).—This is the only Cathro soil mapped in the county. It is in shallow glacial lake basins and depressions.

The content of organic matter is very high, natural fertility is low, and runoff is very slow. Wetness is the most serious hazard to crops. The soil has other severe limitations for most intensive uses. Where drained, it is subject to subsidence, and it becomes highly susceptible to soil blowing if the water level is not properly maintained. Frost is sometimes a hazard to crops, but the influence of Lake Michigan reduces this hazard.

Most undrained areas are in pasture or are wooded. Many drained areas are used for truck crops or sod farms. Capability unit IIIw–8; woodland group 10; shrub and vine group C; wildlife group 6.

Dresden Series

The Dresden series consists of well-drained soils on outwash plains. These soils are moderately deep to sand and gravel. They formed in a loamy or silty mantle and underlying outwash sand and gravel. Slopes are 1 to 3 percent.

In a representative profile the surface layer is very dark grayish-brown silt loam about 8 inches thick. The subsurface layer is about 6 inches thick. It is brown to dark-brown loam, and pinkish-gray coatings are on the soil aggregates. The subsoil, which extends to a depth of about 28 inches, is reddish-brown sandy clay loam in the upper part and clay loam that has a gritty feel in the lower part. The substratum, to a depth of 60 inches, is brown sand and gravel.

Available water capacity is low or medium. Permeability is moderate above the substratum and rapid or very rapid in the substratum. Reaction is mildly alkaline.

Representative profile of Dresden silt loam, 1 to 3 percent slopes (NW¼NW¼ sec. 36, T. 21 N., R. 20 E., 360 yards east of northwest section corner and 30 feet south of road in a cultivated field across road from farm buildings):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; very friable; many roots; mildly alkaline; clear, wavy boundary
A2—8 to 14 inches, brown to dark-brown (7.5YR 4/2) loam; pinkish-gray (7.5YR 6/2) coatings on peds; weak, thin, platy structure; friable; many roots, mildly alkaline; clear, wavy boundary
B21t—14 to 21 inches, reddish-brown (5YR 4/4) sandy clay loam, moderate, fine, subangular blocky structure; firm; thin continuous clay films; few roots; mildly alkaline; clear, wavy boundary
B22t—21 to 28 inches, reddish-brown (5YR 4/4) gritty clay loam, moderate, medium, subangular blocky structure; firm; thin patchy clay films, mildly alkaline, abrupt, smooth boundary
IIC—28 to 60 inches; brown (10YR 5/3) sand and gravel, single grain; loose; calcareous

The solum ranges from 24 to 40 inches in thickness but generally is 24 to 36 inches. The A1 or Ap horizon has a silt loam or sandy loam texture The B horizon ranges from reddish brown to yellowish brown; and texture is silty clay loam, gravelly clay loam, or sandy clay loam The IIC horizon consists of strata of poorly sorted to well sorted calcareous sand and gravel.

The Dresden soils, as mapped in Brown County, have a B horizon that is redder than defined for the series, but this does not alter their usefulness and behavior

Dresden soils occur near Casco, Fabius, and Sebewa soils; but they have a thicker solum than Casco soils and are better drained than Sebewa and Fabius soils.

Dresden sandy loam, 1 to 3 percent slopes (DdA).—This soil is on outwash plains. It has a surface layer that has a higher content of sand than the one in the profile described as representative of the series.

Included with this soil in mapping were areas of a Dresden soil that has a loam surface layer.

Natural fertility is moderate to low in this soil, content of organic matter is medium, and the effective depth to which roots can penetrate ranges from 24 to 40 inches. Good tilth is easily maintained. Runoff is slow. The limited depth suitable for root growth is the main limitation of this soil, and the low available water capacity becomes a limitation during extended dry periods.

This soil is well suited to most of the crops commonly grown in the county and to pasture and hay plants. Capability unit IIIs–4; woodland group 1; shrub and vine group A; wildlife group 1.

Dresden silt loam, 1 to 3 percent slopes (DrA).—This soil is on outwash plains. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of Dresden soils that have a loam surface layer. Also included were a few areas where the depth to sand and gravel is less than 24 inches.

Natural fertility and the content of organic matter are medium in this soil, and the effective depth to which roots can penetrate ranges from 24 to 40 inches. Runoff is slow. Good tilth is easily maintained.

This soil is well suited to most of the crops and pasture and hay plants commonly grown in the county. Capability unit IIs–1; woodland group 1; shrub and vine group A; wildlife group 1.

Dresden Series, Mottled Subsoil Variant

The mottled subsoil variants of the Dresden series consist of somewhat poorly drained soils on outwash plains. These soils are moderately deep to sand and gravel. They formed in a thin loamy or silty mantle and underlying outwash sand and gravel. Slopes are 1 to 3 percent.

In a representative profile the surface layer is very dark grayish-brown silt loam about 9 inches thick. The subsoil extends to a depth of about 34 inches. The upper part is brown to dark-brown silty clay loam with brown and reddish-gray mottles; the middle part is reddish-brown sandy clay loam with strong-brown, reddish-brown, and dark reddish-gray mottles; and the lower part is brown to strong-brown loamy sand. The substratum, to a depth of 60 inches, is reddish-yellow and light yellowish-brown sand and gravel.

Available water capacity is medium in these soils. Permeability is moderate above the substratum and rapid to very rapid in the substratum. Reaction is slightly acid to mildly alkaline.

Representative profile of Dresden silt loam, mottled subsoil variant, 1 to 3 percent slopes, in a cultivated area (SW¼SW¼ sec. 31, T. 22 N., R. 22 E., 30 feet east of road, 100 feet north of field entrance):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, subangular blocky structure; friable; many roots; mildly alkaline, clear, wavy boundary
A1—7 to 9 inches, very dark brown (10YR 2/2) silt loam; weak, medium, subangular blocky structure; friable; many roots; mildly alkaline, abrupt, wavy boundary
B21t—9 to 17 inches, brown to dark-brown (7.5YR 4/4) silty clay loam; few, fine, faint, brown (7.5YR 5/4) and few, fine, distinct, reddish-gray (5YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; many roots; thin continuous clay films on faces of peds, mildly alkaline, clear, wavy boundary
IIB22t—17 to 25 inches, reddish-brown (5YR 4/4) sandy clay loam, many, medium, prominent, strong-brown (7.5YR 5/8) and common, medium, faint, reddish-brown (5YR 5/3) mottles; common, medium, distinct, dark reddish-gray (5YR 4/2) mottles; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; thin patchy clay films on faces of peds; mildly alkaline, gradual, wavy boundary
IIB23t—25 to 31 inches, reddish-brown (5YR 4/4) sandy clay loam; few, medium, faint, reddish-brown (5YR 5/4) mottles; weak, medium, subangular blocky structure, friable; thin patchy clay films on faces of peds; mildly alkaline; clear, wavy boundary
IIB3—31 to 34 inches, brown (7.5YR 5/4) to strong-brown (7.5YR 5/6) loamy sand; weak, medium, subangular blocky structure, friable; mildly alkaline; clear, wavy boundary
IIC—34 to 60 inches, reddish-yellow (7.5YR 6/6) and light yellowish-brown (10YR 6/4) sand and some gravel; single grain; loose; calcareous.

The solum ranges from 24 to 40 inches in thickness but is commonly 30 to 38 inches The A horizon is silt loam, loam, or sandy loam, 6 to 10 inches thick. The B horizon has hues of 7.5YR or 5YR, values of 4 or 5, and chromas of 4 to 6 The C horizon is stratified sand and gravel

Soils of the Dresden series, mottled subsoil variant, are near Sebewa and Casco soils, but they are wetter and have a thicker solum than the Casco soils and are better drained than the poorly drained Sebewa soils.

Dresden sandy loam, mottled subsoil variant, 0 to 2 percent slopes (DeA).—This soil is in drainageways and depressions on glacial outwash plains. The surface layer is sandy loam, has a lower content of organic matter, and generally is lighter colored; but otherwise the profile is similar to that described as representative of the series.

Included with this soil in mapping were small areas of Sebewa soils; small areas of Dresden, mottled subsoil

variant, soils that have slopes of 3 percent; and small areas that have a loam surface layer.

Natural fertility and the organic-matter content of this soil are medium, and the depth to which roots penetrate is 24 to 40 inches. Runoff is slow. Wetness is the main hazard on this soil.

If this soil is drained, it is suited to most of the crops and the pasture and hay grasses commonly grown in the county. Capability unit IIw–5; woodland group 7; shrub and vine group C; wildlife group 5a.

Dresden silt loam, mottled subsoil variant, 1 to 3 percent slopes (DsA).—This soil is in dainageways and depressions on glacial outwash plains. It has the profile described as representative of the Dresden series, mottled subsoil variant.

Included with this soil in mapping were small areas of Dresden, mottled subsoil variant, soils that have a loam surface layer and areas of soils that have a clayey substratum at a depth of 40 inches or more. Also included were areas where slopes are 4 and 5 percent and small areas of poorly drained Sebewa soils.

Natural fertility and organic-matter content in this soil are medium, and the depth to which roots can penetrate is 24 to 40 inches. Runoff is slow. Wetness is the main limitation to use of this soil, and suitable drainage practices are needed to remove excess water.

If drained, this soil is suited to most of the crops and the pasture and hay plants commonly grown in the county. Capability unit IIw–5; woodland group 7; shrub and vine group C; wildlife group 5a.

Dumps

Dumps (Du) are areas of accumulations of trash, garbage, and industrial wastes. Dumps in or near the city of Green Bay mostly consist of wood refuse and wastes from the paper industries of the city. Dump areas that are smoothed and covered with soil material are classed as Fill land.

Because of the variability of material, limitations for specific uses of Dumps cannot be accurately predicted. Not placed in a capability unit, woodland group, or shrub and vine group; wildlife group 8.

Fabius Series

The Fabius series consists of somewhat poorly drained soils of outwash plains. These soils are shallow to sand and gravel. They formed in a thin loamy or silty mantle and underlying outwash sand and gravel. Slopes are 0 to 2 percent.

In a representative profile the surface layer is very dark grayish-brown silt loam about 7 inches thick. The subsoil, which extends to a depth of 18 inches, is brown heavy loam in the upper part, brown to dark-brown sandy clay loam in the middle part, and brown heavy loam in the lower part. Light yellowish-brown, grayish-brown, strong-brown, and light-gray mottles are present throughout the subsoil. The substratum, to a depth of 60 inches, is light yellowish-brown sand and gravel.

Fabius soils have low available water capacity. The subsoil is moderately permeable and the substratum is rapidly or very rapidly permeable. Reaction is mildly alkaline.

Representative profile of Fabius silt loam, 0 to 2 percent slopes, in a cultivated area (NW¼NE¼ sec. 36, T. 23 N., R. 22 E., 20 feet south of road and 750 feet east of farmstead):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; very friable; common roots; mildly alkaline; abrupt, smooth boundary.

B1—7 to 9 inches, brown (10YR 5/3) heavy loam; common, medium, faint, light yellowish-brown (10YR 6/4) and grayish-brown (10YR 5/2) mottles; moderate, fine, subangular blocky structure; friable; common roots; mildly alkaline; abrupt, wavy boundary.

B2t—9 to 14 inches, brown to dark-brown (7.5YR 4/4) sandy clay loam; common, fine, distinct, strong-brown (7.5YR 5/6) and few, fine, prominent, light-gray (5YR 7/1) mottles; moderate, fine and medium, subangular blocky structure, firm; common roots; thin patchy clay films, mildly alkaline; clear, wavy boundary

B3t—14 to 18 inches, brown (7.5YR 5/4) heavy loam; common, fine, distinct, strong-brown (7.5YR 5/6) and few, fine, prominent, light-gray (5YR 7/1) mottles; moderate, fine, subangular blocky structure, firm; thin patchy clay films; mildly alkaline; clear, smooth boundary.

IIC—18 to 60 inches, light yellowish-brown (10YR 6/4) sand and gravel; single grain: loose, calcareous

The solum ranges from 10 to 24 inches in thickness Depth to mottling ranges from 5 to 12 inches In undisturbed areas the A1 horizon is generally thin and is very dark gray (10YR 3/1) In places the Ap horizon is very dark gray (10YR 3/1) or very dark brown (10YR 2/2). The B horizon is heavy loam, sandy clay loam, gravelly clay loam, or light clay loam The IIC horizon consists of strata of poorly sorted to well-sorted, calcareous sand and gravel.

The Fabius soils, as mapped in Brown County, have colors that are redder than defined for the series, but this does not alter their usefulness and behavior

Fabius soils are near Sebewa and Dresden soils. They have a thinner solum (less than 24 inches thick) than these soils, and they are not so wet as the poorly drained Sebewa soils.

Fabius silt loam (0 to 2 percent slopes) (Fa).—This is the only Fabius soil mapped in the county. It is in areas of outwash plains.

Included with this soil in mapping were small areas of Casco soils, areas of mottled subsoil variant soils of the Dresden series, and areas of Sebewa soils.

Natural fertility and content of organic matter are medium in this soil, and depth to which roots can penetrate ranges from 12 to 24 inches. Runoff is slow.

Wetness is the main limitation to use of this soil for crops. Where excessive water is removed by surface drains, the soil is well suited to shallow-rooted crops and fairly well suited to deep-rooted crops. Most undrained areas are used for permanent pasture or are wooded. Capability unit IIw–5; woodland group 7; shrub and vine group C; wildlife group 5a.

Fill Land

Fill land (Fd) is filled and smoothed areas where the fill is mainly soil material of various textures. In some places the fill includes cinders, broken concrete, and industrial wastes.

Nearly all areas of Fill land are in or near the city of Green Bay. They are in the downtown business area,

in industrial areas, and in a large area of the marshland northwest of the city that is presently being filled with dredge spoil from the bay.

Because of the variability of material in Fill land, limitations for specific uses cannot be accurately predicted. Wildlife group 1; capability unit, woodland group, and shrub and vine group not assigned.

Gravel Pits

Gravel pits (Gp) are areas where sand and gravel have been removed to a depth of several feet for use in highway construction and other engineering projects. Most of these pits are in or near areas of Casco, Dresden, Boyer, and Kewaunee soils that have a gravelly substratum.

Gravel pits are scattered throughout the county. They are suited to use for recreation or for wildlife habitat. Not placed in a capability unit, woodland group, and shrub and vine group; wildlife group 8.

Hochheim Series

The Hochheim series consists of deep, well-drained soils on glacial till plains. These soils formed in a thin loamy or silty mantle and underlying calcareous glacial till. Slopes are 2 to 12 percent.

In a representative profile the surface layer is dark-brown loam about 7 inches thick. The subsoil, which extends to a depth of about 19 inches, is yellowish-red heavy clay loam in the upper part, brown to dark-brown light sandy clay loam in the middle part, and brown loam in the lower part. The substratum, to a depth of 60 inches, is very pale brown sandy loam that contains many fragments of limestone.

Hochheim soils have medium available water capacity and moderate permeability. Reaction is neutral to moderately alkaline.

Representative profile of Hochheim loam, 2 to 6 percent slopes, in a cultivated area (NW¼NW¼ sec. 9, T. 24 N., R. 22 E., 50 feet west of fence corner and 20 feet south of road):

Ap—0 to 7 inches, dark-brown (10YR 3/3) loam; moderate, fine, granular structure; very friable; many roots; light-gray (10YR 7/2) silt grains in lower 2 inches; mildly alkaline; clear, wavy boundary.

B21t—7 to 11 inches, yellowish-red (5YR 4/6) heavy clay loam, strong, fine, subangular blocky structure, firm, many roots; thin continuous clay films on faces of peds and in root channels; moderately alkaline; clear, wavy boundary

B22t—11 to 16 inches, brown to dark-brown (7.5YR 4/4) light sandy clay loam; moderate, medium, subangular blocky structure; friable; many roots; thin patchy clay films on faces of peds; white (10YR 8/2) fragments of limestone more than 2 inches in diameter, moderately alkaline; clear, wavy boundary

B3—16 to 19 inches, brown (7.5YR 5/4) loam; weak, fine and medium, subangular blocky structure; friable, many roots; white (10YR 8/2) fragments of limestone more than 2 inches in diameter; calcareous; abrupt, wavy boundary

C—19 to 60 inches, very pale brown (10YR 7/3) sandy loam; massive; very friable; many fragments of limestone, mostly less than 6 inches in diameter; calcareous.

The solum ranges from 12 to 24 inches in thickness but most commonly is 15 to 20 inches Where undisturbed, the A1 horizon is very dark brown (10YR 2/2) in color The A horizon generally is loam, but in places it is silt loam The B horizon has hues of 5YR and 7.5YR, values of 4 to 6, and chromas of 4 and 5. The C horizon is loam or sandy loam, and colors are pale brown, (10YR 6/3) or very pale brown, (10YR 7/3). The volume of coarse fragments in the C horizon ranges from 25 to 40 percent

Hochheim soils are near Sisson and Summerville soils, but they differ from Sisson soils in that they formed in glacial till rather than silty lacustrine sediment. They lack the limestone bedrock that underlies Summerville soils at shallow depths.

Hochheim loam, 2 to 6 percent slopes (HoB).—This soil is on glacial till plains. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of moderately eroded Hochheim soils and a few small areas of Waymor soils.

Natural fertility in this soil is medium, content of organic matter is low, and the depth to which roots can penetrate is about 40 inches. Runoff is medium. Erosion is the main limitation to use of this soil.

In cultivated areas, erosion control will reduce the amount of soil loss. This soil is suited to most of the cultivated crops and the pasture and hay plants commonly grown in the county. Capability unit IIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Hochheim loam, 6 to 12 percent slopes, eroded (HoC2).—This soil is on glacial till plains. The surface layer is lighter colored, and the combined thickness of the surface layer and subsoil is less than that in the profile described as representative of the series.

Included with this soil in mapping were some slightly eroded areas in woodlots and uncultivated areas. Small areas of somewhat poorly drained soil along drainageways were also included.

Natural fertility in this soil is medium, content of organic matter is low, and the depth to which roots can penetrate is about 40 inches. Runoff is medium to rapid, and the hazard of further erosion is severe.

In cultivated areas, erosion control will reduce the amount of soil loss. Adding manure and plowing under crop residue help to maintain good tilth. This soil is suited to most of the cultivated crops and the pasture and hay plants commonly grown in the county. Capability unit IIIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Keowns Series

The Keowns series consists of deep, poorly drained soils. They are in nearly level to depressional areas on glacial lake plains. These soils formed in stratified silt and fine sand sediment.

In a representative profile the surface layer is black silt loam about 6 inches thick. The subsoil, which extends to a depth of 21 inches, is grayish-brown silt loam. It has mottles of strong brown in the lower part. The substratum, to a depth of 60 inches, is brown silt and fine sand that has strong-brown and grayish-brown mottles.

Keowns soils have medium available water capacity and moderate permeability. Reaction is moderately alkaline.

Representative profile of Keowns silt loam, 0 to 2 percent slopes, in idle land (T. 23 N., R. 20 E., Public

Claim 32, 0.4 mile east of intersection of County Highways GG and GE and 60 feet north of County Highway GG, northwest of Austin Straubel Airport):

A1—0 to 6 inches, black (10YR 2/1) silt loam, moderate, medium, granular structure; very friable, common roots; mildly alkaline; abrupt, irregular boundary.

B1g—6 to 12 inches, grayish-brown (2.5Y 5/2) silt loam; weak, medium, platy structure parting to weak, fine, subangular blocky; friable, common roots; moderately alkaline, clear, irregular boundary

B2g—12 to 21 inches, grayish-brown (10YR 5/2) silt loam, many, medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, fine, subangular blocky structure; friable, moderately alkaline; clear, wavy boundary

C—21 to 60 inches, brown (7.5YR 5/4) silt and fine sand, many, medium, prominent, strong-brown (7.5YR 5/8) and few, fine, distinct, grayish-brown (10YR 5/2) mottles; massive; nonsticky when wet; moderately alkaline.

The solum ranges from 15 to 30 inches in thickness The A1 or Ap horizon is 6 to 10 inches thick The B horizon has hues of 10YR, 2.5Y, and 5Y. It is fine sandy loam to silt loam The C horizon generally is stratified silt and fine sand, but in places it contains thin layers of silty clay loam

The Keowns soils mapped in Brown County lack the free carbonates in the solum that are defined for the series, but this does not alter their usefulness and behavior.

Keowns soils are near Yahara and Pella soils They are wetter than the somewhat poorly drained Yahara soils and have a lower clay content in the B horizon than Pella soils

Keowns silt loam (0 to 2 percent slopes) (Ke).—This is the only Keowns soil mapped in the county. It is on nearly level areas or in depressions on glacial lake plains.

Small areas of Yahara and Kibbie soils were included with this soil in mapping.

Natural fertility and the content of organic matter in this soil are medium. The effective depth to which roots can penetrate is 40 inches or more.

Wetness is the main limitation to use of the soil, and drainage is needed for good crop growth. Open-ditch drainage is the most suitable for this soil. Undrained areas generally are used for permanent pasture or are wooded. Capability unit IIIw-3; woodland group 7; shrub and vine group C; wildlife group 5b.

Kewaunee Series

The Kewaunee series consists of deep, well drained and moderately well drained soils on glacial till plains and ridges. These soils formed in a thin mantle of silty or loamy material and in the underlying clayey glacial till. Slopes range from 2 to 30 percent.

In a representative profile the surface layer is very dark grayish-brown silt loam about 5 inches thick. The subsurface layer is grayish-brown silt loam about 3 inches thick. The subsoil, which extends to a depth of about 27 inches, is reddish-brown silty clay loam in the upper part and reddish-brown silty clay in the lower part. The substratum, to a depth of 60 inches, is reddish-brown heavy clay loam. Pebbles as large as 3 inches in diameter are common throughout the subsoil and substratum.

Kewaunee soils have high available water capacity and slow permeability. Reaction is slightly acid to mildly alkaline.

Representative profile of Kewaunee silt loam, 2 to 6 percent slopes, in an area of idle land (SE¼NW¼, sec. 22, T. 23 N., R. 21 E., along railroad track 100 yards northwest of town road at railroad crossing):

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, subangular blocky structure parting to moderate, fine, crumb structure; friable; neutral; abrupt, irregular boundary.

A2—5 to 8 inches, grayish-brown (10YR 5/2) silt loam; weak, medium, platy structure parting to moderate, fine, subangular blocky; slightly hard; some peds with reddish-brown (5YR 5/4) interior colors, mostly less than 10 millimeters in diameter; worm casts of very dark grayish brown (10YR 3/2); slightly acid; abrupt, irregular boundary

B1t—8 to 11 inches, reddish-brown (5YR 5/4) silty clay loam; weak to moderate, medium, subangular blocky structure; hard when dry, pebbles as large as 3 inches in diameter, mostly less than 10 millimeters; patchy clay films; light brownish-gray (10YR 6/2) coatings on peds; slightly acid; clear, irregular boundary

B2t—11 to 20 inches, reddish-brown (2.5YR 4/4) silty clay; moderate, medium, subangular blocky structure parting to moderate and strong, fine, angular blocky; very hard when dry, pebbles as large as 3 inches in diameter but most are less than 10 millimeters; continuous clay films; neutral; clear, irregular boundary

B3t—20 to 27 inches, reddish-brown (2.5YR 4/4) silty clay; weak, medium, prismatic structure parting to moderate, medium and fine, angular blocky; very hard when dry, pebbles as large as 3 inches in diameter but most are less than 10 millimeters, patchy clay films; pale-brown (10YR 6/3) discontinuous seam of free carbonates, ¼ to ½ inch thick, at lower contact; abrupt, irregular boundary

C—27 to 60 inches, reddish-brown (5YR 4/3) heavy clay loam; moderate, medium and coarse, angular blocky structure; very hard when dry, pebbles as large as 3 inches in diameter but most are less than 10 millimeters; light reddish-brown (5YR 6/3) free carbonates, strongly calcareous.

The solum commonly is 24 to 36 inches thick but ranges from 20 to 40 inches. The A1 horizon has hues of 10YR or 7.5YR, values of 3 or 4, and chromas of 2 to 4 Texture of the A horizon is sandy loam, silt loam, or silty clay loam The silty clay loam occurs in areas of eroded soils and the sandy loam in areas where a thin deposit of sandy drift overlies the finer textured glacial till The A2 horizon has hues of 10YR or 7.5YR, values of 4 or 5, and chromas of 2 or 3 The texture in many places is like that of the A1 horizon In some places where the soil has been plowed deeply, the A2 horizon is mixed with the Ap horizon. The major part of the B horizon has hues of 5YR or 2.5YR, values of 4 or 5, and chromas of 3 to 6 The texture is clay or silty clay The C horizon has colors similar to those of the B horizon Texture is heavy clay loam, silty clay, and light clay.

Kewaunee soils are near Manawa and Poygan soils They form a drainage sequence with the somewhat poorly drained Manawa soils and the poorly drained Poygan soils.

Kewaunee sandy loam, 2 to 6 percent slopes (KfB).—This soil (fig. 10) is on glacial till plains. The surface layer has a higher sand content than that in the profile described as representative of the series.

Included with this soil in mapping were some areas of nearly level Kewaunee soils, a small area of Manawa soils in drainageways, some small areas of eroded Kewaunee soils, and areas of Manistee soils.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. Erosion is the main hazard on this soil.

Erosion-control practices are beneficial if row crops are planted. The soil is well suited to the crops commonly grown in the county. Capability unit IIe-6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee sandy loam, 6 to 12 percent slopes, eroded (KfC2).—This soil is on glacial till plains. The surface layer

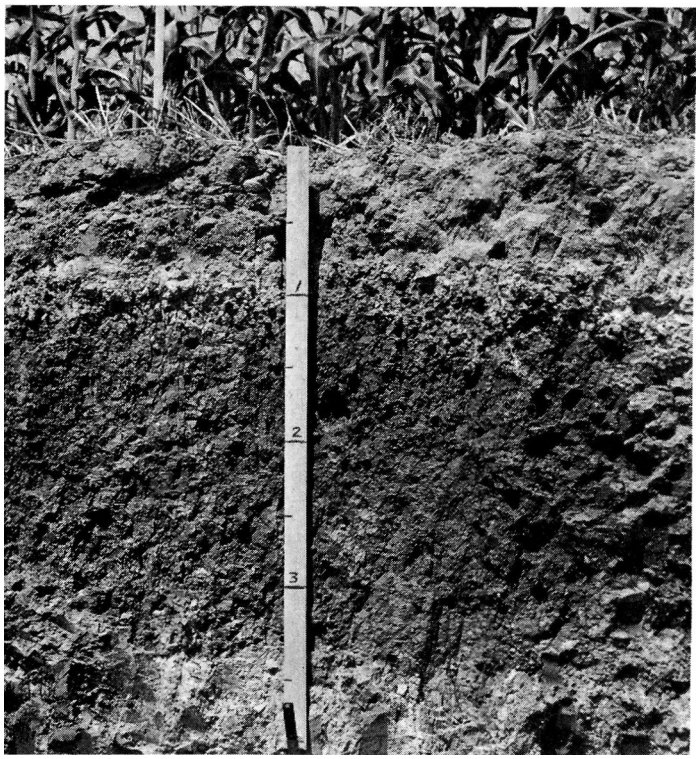

Figure 10.—**Typical profile of a Kewaunee sandy loam. The high content of clay in the subsoil and the substratum limits use of this soil as a site for septic tank filter fields.**

of this soil is thinner and has a higher sand content than that in the profile described as representative of the series. The plow layer is a mixture of the original surface layer and a moderate amount of reddish-brown material from the subsoil.

Included with this soil in mapping were areas of gently sloping and moderately steep Kewaunee soils, a limited acreage of Manawa soils in drainageways, and small areas of slightly eroded to severely eroded Kewaunee soils.

Natural fertility in this soil is high, organic-matter content is low, and the effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. Further erosion is the main hazard.

Erosion-control practices are beneficial if row crops are grown. This soil is well suited to all crops commonly grown in the county. Capability unit IIIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee loam, gravelly substratum, 2 to 6 percent slopes (KgB).—This soil is on glacial till plains. Stratified medium sand and gravel is present at a depth ranging from 40 to 60 inches, but the profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping were some small areas of gently sloping Kewaunee silt loam and a few areas of eroded soils.

Erosion is the main hazard on this soil, and practices that control runoff and soil loss are beneficial. The soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee silt loam, 2 to 6 percent slopes (KhB).—This soil is on glacial till plains. It has the profile described as representative of the series.

Included with this soil in mapping were some small areas of nearly level and sloping Kewaunee soils, areas of Manawa soils along drainageways, and some areas of Kewaunee soils that have a loam surface layer.

Natural fertility in this soil is high, and organic-matter content is low. Runoff is medium, and the effective depth to which roots can penetrate is 40 inches or more. Erosion is the main hazard when this soil is cultivated.

Erosion control will reduce the amount of soil loss. The soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee silt loam, 2 to 6 percent slopes, eroded (KhB2).—This soil is on glacial till plains. The surface layer is thinner than the one in the profile described as representative of the series. The plow layer is a mixture of the original surface layer and a moderate amount of reddish-brown material from the subsoil.

Included with this soil in mapping were areas of nearly level and sloping Kewaunee soils, a limited acreage of Manawa soils along drainageways, and some small areas of Kewaunee soils that have a loam surface layer. Some areas of severely eroded Kewaunee soils were also included.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. Further erosion is the main hazard on this soil.

When the soil is cultivated intensively, erosion control will reduce the amount of soil loss. The use of green manure crops and the application of barnyard manure help to maintain good tilth. This soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee silt loam, 6 to 12 percent slopes, eroded (KhC2).—This soil is on glacial till plains. It has a thinner surface layer than the one in the profile described as representative of the series. The plow layer is a mixture of the original surface layer and a moderate amount of the reddish-brown subsoil.

Included with this soil in mapping were some areas of gently sloping and moderately steep Kewaunee soils, a limited acreage of Manawa soils along drainageways, and some small areas of Kewaunee soils that have a loam surface layer.

Natural fertility in this soil is high, and organic-matter content is low. Runoff is medium. The effective depth to which roots can penetrate is 40 inches or more. Further erosion is the main hazard on this soil.

Erosion control will reduce the amount of soil loss. The use of barnyard manure and green manure crops will help to maintain good tilth. This soil is well suited to all crops commonly grown in the county. Capability unit IIIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee silt loam, 12 to 20 percent slopes, eroded (KhD2).—This soil is on ridges and slopes of ravines on glacial till plains. The surface layer and the subsoil are thinner than those in the profile described as representative of the series.

Included with this soil in mapping were areas of sloping to steep Kewaunee soils, small areas of Kewaunee soils that have loam and sandy loam surface layers, and areas of Kewaunee soils that are slightly eroded.

Natural fertility in this soil is high, and organic-matter content is low. Runoff is medium, and the effective depth to which roots can penetrate is 40 inches or more. The hazard of further erosion is the main limitation to use of this soil.

Erosion control will reduce the amount of soil loss in cultivated areas. Most of the soil is in trees or is permanent pasture. Capability unit IVe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee silt loam, 20 to 30 percent slopes, eroded (KhE2).—This soil is on ridges and the sides of ravines in glacial till plains. The surface layer and subsoil are thinner than those in the profile described as representative of the series.

Included with this soil in mapping were areas of moderately steep and very steep Kewaunee soils, areas of Kewaunee soils that have a loam surface layer, and areas of Kewaunee soils that are only slightly eroded.

Natural fertility in this soil is medium, and organic-matter content is low. Runoff is rapid. The hazard of further erosion is severe on this soil.

This soil is not suited to cultivated crops. Most of the acreage is wooded or is used for permanent pasture. Capability unit VIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee soils, 6 to 12 percent slopes, severely eroded (KkC3).—These soils are in small areas on glacial till plains. The surface layer is clayey and reddish brown, but the profile is otherwise similar to that described as representative of the series.

Included with this soil in mapping were small areas of gently sloping and moderately steep Kewaunee soils. A limited acreage of severely eroded Oshkosh soils was also included.

Natural fertility is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is rapid. Further erosion is the main hazard on this soil. If the soils are tilled when wet, they tend to puddle and the soil material dries in hard clods.

Control against further erosion is beneficial where the soil is planted to row crops. Applying barnyard manure and plowing under green manure improves fertility and tilth. This soil is suited to all crops commonly grown in the county. It is especially suited to alfalfa. Capability unit IVe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee soils, 12 to 20 percent slopes, severely eroded (KkD3).—These soils are on ridges in glacial till plains. The surface layer is clayey and reddish brown in color, but otherwise the profile is similar to that described as representative of the series.

Included with these soils in mapping were small areas of sloping and steep Kewaunee soils and a small acreage of severely eroded Oshkosh soils.

Natural fertility in these soils is medium, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is rapid. Clods form if these soils are tilled when wet. The major hazard is further erosion.

The use of barnyard manure or green-manure crops helps to maintain fertility and good tilth. Erosion control will reduce the amount of soil loss where row crops are grown.

This soil is better suited to hay, pasture, and trees than to cultivated crops. Capability unit VIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee soils, 20 to 30 percent slopes, severely eroded (KkE3).—This soil is in small areas on ridges in glacial till plains. The surface layer is clayey and reddish brown in color, but the profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping were small areas of moderately sloping and very steep Kewaunee soils and a limited acreage of severely eroded Oshkosh soils.

Natural fertility in this soil is medium, and organic-matter content is low. Runoff is rapid. Further erosion is the main hazard.

This soil is better suited to permanent pasture or trees than to cultivated crops. Capability unit VIIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kewaunee-Manawa complex, 2 to 6 percent slopes (KlB).—About 60 percent of the acreage of this mapping unit is Kewaunee silt loam, and about 40 percent is Manawa silty clay loam. The soils are on glacial till plains, and slopes are complex. The Manawa soils are in depressions and drainageways, and the Kewaunee soils occupy higher areas. Included in mapping were small areas of Poygan soils.

In the Kewaunee part of the mapping unit, erosion is the major hazard to crops. In the Manawa part, wetness is the major hazard. Soils of this mapping unit are suited to all the crops commonly grown in the county, and most of the acreage is cultivated. Areas not cultivated are in pasture or are wooded. Capability unit IIe–6; woodland group 2; shrub and vine group C; wildlife group 2.

Kewaunee-Manawa complex, 2 to 6 percent slopes, eroded (KlB2).—About 60 percent of the acreage of this mapping unit is Kewaunee silt loam, and about 40 percent is Manawa silty clay loam. Small areas of Poygan soils were included in mapping.

In many areas the Kewaunee soils are eroded and the reddish-brown subsoil is exposed. In these areas tillage has mixed subsoil material with the remaining surface layer. The main hazards on the soils of this complex are further erosion of the Kewaunee soils and wetness of the Manawa soils.

Most of the acreage is cultivated, and it is suitable for all crops commonly grown in the county. Uncultivated areas are in pasture or are wooded. Capability unit IIe–6; woodland group 2; shrub and vine group C; wildlife group 2.

Kewaunee-Sisson complex, 15 to 30 percent slopes, eroded (KmE2).—This mapping unit consists of Kewaunee and Sisson soils that occur in an intermingled pattern on hillsides on glacial till plains. About 55 percent of the acreage is Kewaunee silt loam, and about 45 percent is Sisson sandy loam. Stratified silt and fine sand, like that from which the Sisson soils formed, occur in undulating strata in the clayey till of the Kewaunee soils. Included with this soil in mapping were small areas of Kewaunee silty clay loam and areas of Sisson loam. In places the

substratum of the Kewaunee soil is underlain by silt and fine sand at a depth ranging from 2 to 5 feet. In other places the Sisson soil is underlain by a clayey substratum. Otherwise the profiles of the soils in this complex are similar to the profiles described as representative of the respective series.

The hazard of further erosion is the major limitation to use of the soils in this complex. Only a small part of the acreage is cultivated. Most of it is in pasture or is wooded. Capability unit IVe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Kibbie Series

The Kibbie series consists of deep, nearly level to very gently sloping, somewhat poorly drained soils of glacial lake plains. These soils formed in stratified, calcareous silt and very fine sand containing thin, finer textured layers.

In a representative profile the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is about 2 inches thick. It is brown silt loam with gray and yellowish-red mottles. The subsoil, which extends to a depth of 26 inches, is brown to dark brown and has gray and yellowish-red mottles throughout. The upper part is silty clay loam, and the lower part is loam. The substratum, to a depth of 46 inches, is stratified brown silt and fine sand. Below this, to a depth of 60 inches, is reddish-brown silt that has thin layers of silty clay loam and silty clay.

Kibbie soils have medium available water capacity and moderately slow permeability. Reaction is neutral. In wet seasons water is held above the moderately slowly permeable substratum.

Representative profile of Kibbie silt loam in a cultivated area (T. 23 N., R. 20 E., Public Claim 41, 0.5 mile north of intersection of County Highways G and GV, 330 feet south of bridge, and 30 feet east of road):

Ap—0 to 8 inches, very dark gray (10YR 3/1 silt loam; weak, medium, subangular blocky structure parting to moderate, medium, granular; very friable; common roots; neutral; clear, irregular boundary.

A2—8 to 10 inches, brown (10YR 5/3) silt loam; common, fine, distinct, gray (10YR 5/1) and common, fine, prominent, yellowish-red (5YR 4/6) mottles; weak, fine and medium, subangular blocky structure; friable; common roots; neutral; abrupt, irregular boundary.

B1—10 to 15 inches, brown to dark-brown (7.5YR 4/2) silty clay loam; common, fine, faint, gray (10YR 5/1) and common, fine, prominent, yellowish-red (5YR 4/6) mottles; moderate, medium, subangular blocky structure; firm; neutral; clear, irregular boundary.

B2t—15 to 20 inches, brown to dark-brown (10YR 4/3) silty clay loam; common, fine, distinct, gray (10YR 5/1) and common, fine, prominent, yellowish-red (5YR 4/6) mottles; weak, medium, subangular blocky structure parting to moderate, fine, subangular blocky; firm; thin patchy clay films on faces of peds; neutral; clear, irregular boundary.

B3—20 to 26 inches, brown to dark-brown (10YR 4/3) loam; common, fine, distinct, gray (10YR 5/1) and common, fine, prominent, yellowish-red (5YR 4/6) mottles; weak, coarse, subangular blocky structure; friable; neutral to mildly alkaline; clear, wavy boundary.

C1—26 to 46 inches, brown (7.5YR 5/4) stratified silt and fine sand; many, medium, prominent, strong-brown (7.5YR 5/8) mottles; friable; calcareous; abrupt, wavy boundary.

C2—46 to 60 inches, reddish-brown (5YR 5/4) friable silt with stratified thin layers of firm silty clay loam and silty clay, calcareous.

The solum ranges from 24 to 48 inches in thickness. The A1 horizon ranges in color from very dark grayish brown (10YR 3/2) to black (10YR 2/1). The B horizon is heavy loam, heavy silt loam, or silty clay loam and has hues of 7.5YR or 10YR, values of 4 or 5, and chromas of 2 or 3. The average clay content of the B horizon is 18 to 30 percent. Silt, very fine sand, and fine sand are the dominant textures of the C horizon. Thin bands of silty clay loam or silty clay occur in places. The thickness and sequence of layers vary considerably.

Kibbie soils are near Yahara and Briggsville soils. They are wetter and have a lower clay content in the B and C horizons than Briggsville soils, and they have a higher clay content in the B horizon than Yahara soils.

Kibbie silt loam, 1 to 3 percent slopes (KnA).—This soil is on glacial lake plains. Included in mapping were a few areas where the substratum lacked the fine sand layers of the representative profile. Some small areas of Yahara soils were also included.

Natural fertility in this soil is medium, and the content of organic matter is high. Runoff is slow. The effective depth to which roots can penetrate is 40 inches or more.

Wetness is the main limitation to use of this soil. If drained, the soil is well suited to crops. Undrained areas generally are used for pasture or are wooded. Capability unit IIw–2; woodland group 7; shrub and vine group C; wildlife group 5a.

Kolberg Series

The Kolberg series consists of moderately deep, well-drained soils of glacial till plains. These soils formed in a thin silt layer and underlying clayey till. They are underlain by limestone bedrock. The underlying bedrock strongly influences the topography of the Kolberg soils. Slopes are 1 to 12 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsurface layer is brown to dark-brown silt loam about 6 inches thick. The subsoil extends to a depth of about 30 inches. The upper part of the subsoil is a mixture of brown to dark-brown silt loam and reddish-brown silty clay loam. The middle part is reddish-brown and dark reddish-brown silty clay, and the lower part is reddish-brown to yellowish-red silty clay loam. The substratum is reddish-brown loam about 3 inches thick. It is underlain by limestone bedrock at a depth of about 33 inches.

Kolberg soils have medium available water capacity and moderately slow permeability. Reaction is neutral.

Representative profile of Kolberg silt loam, 2 to 6 percent slopes, in a cultivated area (NE¼SE¼ sec. 7, T. 24 N., R. 22 E., 250 feet west and 175 feet south of road intersection):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

A2—7 to 11 inches, brown (7.5YR 5/3) silt loam; weak and moderate, coarse and medium, platy structure; friable; neutral; clear, wavy boundary.

A&B—11 to 13 inches, brown to dark-brown (7.5YR 4/2–5/2) tongues of silt loam 15 to 20 millimeters wide that have weak, medium, platy structure and penetrate brown (7.5YR 5/4) heavy silt loam that has weak, medium, subangular blocky structure; friable;

tongues occupy 50 to 75 percent of horizon; neutral; abrupt, wavy boundary.

B&A—13 to 16 inches, brown (7.5YR 5/3) tongues of silt loam 15 to 20 millimeters wide that have weak, medium, platy structure and penetrate reddish-brown (5YR 4/4) silty clay loam that has weak, coarse, prismatic structure parting to moderate, coarse and medium, subangular blocky; firm; tongues occupy 20 to 50 percent of the horizon; neutral; abrupt, wavy boundary.

IIB2t—16 to 23 inches, reddish-brown (5YR 4/4) and dark reddish-brown (5YR 3/4) silty clay; weak, coarse, prismatic structure parting to moderate, medium and strong, fine subangular blocky; firm; thin continuous clay films; neutral; gradual, wavy boundary.

IIB3t—23 to 30 inches, reddish-brown (5YR 4/4) and yellowish-red (5YR 5/8) silty clay loam; common, fine, distinct, strong-brown (7.5YR 5/6–5/8) mottles; moderate, medium, subangular blocky structure; firm; common thin clay films; neutral; clear, irregular boundary.

IIC—30 to 33 inches, reddish-brown (5YR 5/4) loam; massive parting to weak, medium, subangular blocky structure; friable; mildly alkaline; abrupt, smooth boundary.

IIIR—33 to 60 inches, limestone bedrock that is layered and highly fissured

The solum ranges from 20 to 40 inches in thickness Tongues of A2 horizon material surround thin, columnlike upward extensions of the Bt horizon or completely surround small, isolated remnants of Bt horizon material. The Bt horizon has hues of 2.5YR to 7.5YR, values of 3 or 4, and chromas of 3 to 6. Texture is silty clay loam, silty clay, or clay The IIC horizon is loamy or clayey residum from limestone and is 2 to 10 inches thick.

Kolberg soils are near Bonduel soils and near Summerville, clayey subsoil variants They are better drained than the Bonduel soils and are deeper to bedrock than the Summerville, clayey subsoil variants

Kolberg silt loam, 1 to 6 percent slopes (KoB).—This soil is on glacial till plains. It has the profile described as representative of the Kolberg series.

Included with this soil in mapping were some areas of Kolberg soils that have a loam till substratum, some spots of eroded soils, a limited acreage of sloping Kolberg soils, and Kolberg soils that have bedrock at a depth of less than 20 inches.

Natural fertility in this soil is high, and organic-matter content is low. Runoff is medium. The effective depth to which roots can penetrate is 20 to 40 inches. Erosion is the main hazard on this soil, and erosion-control practices are beneficial where the soil is cultivated.

The soil is well suited to all crops commonly grown in the county. Capability unit IIe–2; woodland group 2; shrub and vine group A; wildlife group 1.

Kolberg silt loam, 6 to 12 percent slopes, eroded (KoC2).—This soil is on glacial till plains. The surface layer and the subsoil are thinner than those in the profile described as representative of the series. The original surface layer has been mixed by tillage with the upper part of the subsoil, and the present plow layer is a lighter color.

Included with this soil in mapping were areas of a gently sloping Kolberg soil and a limited acreage of severely eroded Kolberg soils.

Natural fertility in this soil is high, and organic-matter content is low. Runoff is medium. The effective depth to which roots can penetrate is 20 to 40 inches. Further erosion is the main hazard.

Erosion-control practices are beneficial in cultivated areas. Good tilth can be maintained by applying barnyard manure and plowing under green-manure crops.

This soil is well suited to all crops commonly grown in the county. Capability unit IIIe–2; woodland group 2; shrub and vine group A; wildlife group 1.

Lamartine Series

The Lamartine series consists of deep, somewhat poorly drained soils on glacial till plains. These soils formed in a silt mantle and the underlying calcareous glacial till. Slopes are 0 to 3 percent.

In a representative profile the surface layer is very dark grayish-brown silt loam about 8 inches thick. The subsurface layer is about 7 inches thick. It is dark grayish-brown silt loam with yellowish-brown mottles. The subsoil extends to a depth of about 38 inches. The upper part is olive-brown silt loam with yellowish-brown and gray mottles, the middle part is a brown silty clay loam with yellowish-brown and gray mottles, and the lower part is yellowish-brown sandy clay loam. The substratum, to a depth of 60 inches, is strong-brown loam glacial till.

Lamartine soils have a high available water capacity and moderately slow permeability. In wet seasons water is held above the moderately slowly permeable substratum. Reaction is mildly alkaline.

Representative profile of Lamartine silt loam in a cultivated area (T. 21 N., R. 20 E., SE¼SW¼ sec. 12. 0.3 mile east of the southwest section corner and 50 feet north of Town Road):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, subangular blocky structure; firm; mildly alkaline; abrupt, smooth boundary.

A2—8 to 15 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, prominent, yellowish-brown (10YR 5/8) mottles; weak, fine, subangular blocky structure; very friable; mildly alkaline; gradual, smooth boundary.

B1—15 to 22 inches, olive-brown (2.5Y 4/4) silt loam; few, fine, prominent, yellowish-brown (10YR 5/8) and gray (10YR 5/1) mottles; weak, medium, subangular blocky structure; very friable; mildly alkaline; gradual, smooth boundary

B21t—22 to 34 inches, brown (10YR 5/3) silty clay loam; few, fine, prominent, yellowish-brown (10YR 5/8) and few, fine, distinct, gray (10YR 5/1) mottles; moderate, medium, subangular blocky structure; firm; thin patchy clay films; mildly alkaline; clear, smooth boundary.

IIB22t—34 to 38 inches, yellowish-brown (10YR 5/4) sandy clay loam; moderate, medium, subangular blocky structure; firm; thin continuous clay films; mildly alkaline; gradual, smooth boundary

IIC—38 to 60 inches, strong-brown (7.5YR 5/6) loam glacial till; massive; friable; calcareous

The solum ranges from 24 to 40 inches in thickness but generally is 30 to 40 inches Thickness of the silt mantle ranges from 20 to 36 inches. Reaction in the solum ranges from slightly acid to mildly alkaline The underlying loam till is highly calcareous The Ap horizon is very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1). The B2t horizon generally has hues of 10YR or 7.5YR, value of 4 or 5, and chromas of 3 to 5 The B horizon formed in both loess and glacial till.

Lamartine soils are commonly associated with the well-drained Waymor and poorly drained Pella soils They occupy drainageways and depressions. Lamartine soils are not so wet as Pella soils.

Lamartine silt loam, 0 to 3 percent slopes (LaA).—This is the only Lamartine soil mapped in the county. It is on till plains.

Included with this soil in mapping were small areas of a Lamartine soil in which depth to the glacial till substratum is more than 36 inches. Also included were small areas of Pella soils and soils that have a sandy loam glacial till substratum.

Natural fertility in this soil is high, and organic-matter content is medium. Runoff is slow. Wetness is the main limitation to use of this soil.

Tile drains are effective in removing excess water. The soil is well suited to crops if it is drained. Capability unit IIw–2; woodland group 7; shrub and vine group C; wildlife group 5a.

Manawa Series

The Manawa series consists of deep, somewhat poorly drained soils in drainageways and shallow depressions on lacustrine and glacial till plains. These soils formed in calcareous, clayey lacustrine deposits or clayey glacial till. Slopes are 1 to 3 percent.

In a representative profile the surface layer is very dark brown silty clay loam about 8 inches thick. The subsoil, which extends to a depth of about 30 inches, is dark reddish-gray silty clay in the upper part, reddish-brown silty clay over reddish-brown heavy silty clay loam in the middle part, and reddish-brown clay loam in the lower part. Yellowish-red and gray mottles are present throughout the subsoil. The substratum, to a depth of 60 inches, is reddish-brown heavy clay loam.

Manawa soils have high available water capacity and slow permeability. In wet seasons, water is held above the slowly permeable substratum. Reaction is neutral to mildly alkaline.

Representative profile of Manawa silty clay loam, 1 to 3 percent slopes, in a cultivated area (SW¼NW¼ sec. 35, T. 23 N., R. 19 E., 0.25 mile south and 60 feet east of the northwest section corner):

Ap—0 to 8 inches, very dark brown (10YR 2/2) silty clay loam; moderate, fine, subangular blocky structure; friable; common fibrous roots; mildly alkaline; abrupt, irregular boundary.

B1g—8 to 12 inches, dark reddish-gray (5YR 4/2) silty clay; common, medium, prominent, yellowish-red (5YR 4/8) mottles; moderate, medium, subangular blocky structure; very firm; common roots; faint streaks of gray (5YR 5/1) and dark gray (5YR 4/1) along root channels; neutral; abrupt, irregular boundary

B21t—12 to 22 inches, reddish-brown (5YR 4/3) silty clay; common, fine, prominent, yellowish-red (5YR 4/8) mottles; moderate to strong, medium, subangular blocky structure; very firm; few roots; distinct streaks of dark gray (5YR 4/1) along root channels; moderately thick continuous clay films on faces of peds; neutral; gradual, irregular boundary.

B22t—22 to 27 inches, reddish-brown (5YR 4/3) heavy silty clay loam; common, medium, prominent, yellowish-red (5YR 4/8) mottles; moderate, medium, subangular blocky structure; very firm, few roots; distinct streaks of dark gray (5YR 4/1) along root channels; moderately thick continuous clay films on faces of peds; slightly alkaline; clear, irregular boundary.

B3—27 to 30 inches, reddish-brown (5YR 4/3) clay loam; many, medium, prominent, yellowish-red (5YR 4/8) and common, fine, distinct, dark-gray (5YR 4/1) mottles; weak, medium, subangular blocky structure; friable; moderately alkaline; abrupt, irregular boundary.

C—30 to 60 inches, reddish-brown (5YR 4/4) heavy clay loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; firm; calcareous.

The solum ranges from 20 to 36 inches in thickness but commonly is 28 to 33 inches The A horizon is black (10YR 2/1) to very dark grayish-brown (10YR 3/2) sandy loam, silt loam, and silty clay loam 6 to 10 inches thick The A2 horizon ranges from incipient to distinct. In places it is incorporated with the Ap horizon. The Bt horizon is silty clay or heavy silty clay loam. It has hues of 5YR or 2 5YR, values of 4 or 5, and chromas of 3 or 4. The C horizon is typically heavy clay loam but ranges to clay. The C horizon has hues of 5YR or 2 5YR. The number of glacial pebbles throughout the profile varies.

Manawa soils are near Kewaunee, Oshkosh, and Poygan soils. They are wetter than the Kewaunee and Oshkosh soils and not so wet as the Poygan soils. Manawa soils also are associated with Shullsburg, wet variant, soils that occur in the vicinity of the Niagara escarpment. They lack the olive-gray weathered shale substratum of these Shullsburg soils

Manawa sandy loam, 1 to 3 percent slopes (MaA).—This soil is in depressions and drainageways on glacial till and lacustrine plains. It has a lighter colored and coarser textured surface layer than the one in the profile described as representative of the series.

Included with this soil in mapping were small areas of Allendale soils, small areas of Manawa soils that have slopes of 4 and 5 percent, and small areas of soils that have a loam surface layer.

Natural fertility and content of organic matter are high. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow, and wetness is the main limitation.

If drained, this soil is suited to most of the field crops and the pasture and hay plants commonly grown in the county. Capability unit IIw–2; woodland group 7; shrub and vine group C; wildlife group 5a.

Manawa silty clay loam, 1 to 3 percent slopes (McA).—This soil is in depressions and drainageways on glacial till and lacustrine plains. It has the profile described as representative of the series (fig. 11).

Included with this soil in mapping were areas of poorly drained Poygan soils, small areas of moderately well drained Kewaunee and Oshkosh soils, and areas of Manawa soils that have an alluvial accumulation of 2 to 6 inches in places. Small areas of Manawa soils that have slopes of 4 and 5 percent are also included.

This soil has high natural fertility and a high content of organic matter. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Wetness is the main hazard on this soil.

Using tile drains, applying manure, and returning crop residue to the soil help to make this soil more suitable for crops. If drained, this soil is suited to most of the crops and the pasture and hay plants commonly grown in the county. Capability unit IIw–2; woodland group 2; shrub and vine group C; wildlife group 5a.

Manistee Series

The Manistee series consists of deep, well drained and moderately well drained soils on lacustrine plains and beach ridges. These soils formed in sandy material and underlying clayey lacustrine sediment or glacial till. Slopes are 2 to 14 percent.

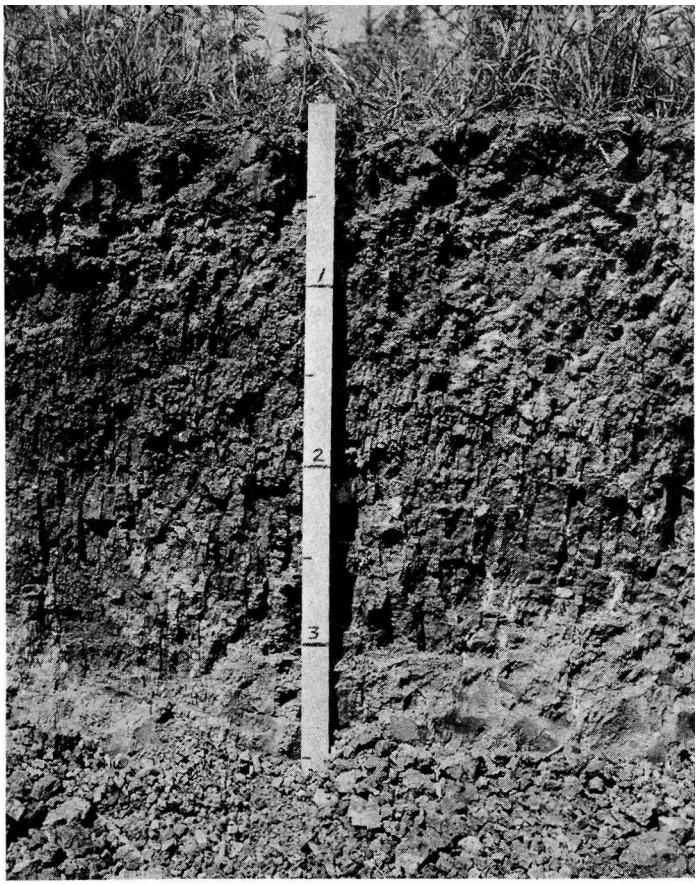

Figure 11.—**Typical profile of a Manawa silty clay loam. The blocky structure is favorable for draining this soil by use of tile drains.**

In a representative profile the surface layer is very dark grayish-brown loamy fine sand about 5 inches thick. The subsoil extends to a depth of about 46 inches. It is brown to dark-brown loamy fine sand or fine and medium sand in the upper part and reddish-brown silty clay in the lower part. The substratum, to a depth of about 60 inches, is a reddish-brown silty clay.

Manistee soils have medium available water capacity. Permeability is rapid in the sandy material and slow in the clayey material. Reaction is slightly acid to moderately alkaline.

Representative profile of Manistee loamy fine sand, 2 to 6 percent slopes, in a cultivated area (T. 23 N., R. 20 E., Public Claim 23, ¼ mile west of Highway 32–41, 375 feet north of County Trunk HH, 100 feet west of the road):

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, fine, subangular blocky structure parting to weak, very fine, subangular blocky; very friable; many roots; slightly acid, clear, wavy boundary.

B21ir—5 to 11 inches, brown to dark-brown (10YR 4/3) loamy fine sand; weak, fine, subangular blocky structure; very friable; many roots; slightly acid; clear, wavy boundary.

B22ir—11 to 24 inches, brown to dark-brown (7.5YR 4/4) fine sand; weak, fine and medium, subangular blocky structure; very friable; many roots in upper 7 inches only; slightly acid; clear, wavy boundary.

A'&B'—24 to 27 inches, brown to dark-brown (7.5YR 4/4, 5/4, and 5/2) fine and medium sand; weak, fine and medium, subangular blocky structure; slightly brittle; neutral; abrupt, smooth boundary.

IIB'21t—27 to 37 inches, reddish-brown (5YR 4/4) silty clay, moderate, fine and medium, angular blocky structure; firm; continuous clay films; mildly alkaline; clear, smooth boundary.

IIB'22t—37 to 46 inches, reddish-brown (5YR 5/3) silty clay, moderate, medium, angular blocky structure; firm; continuous clay films on faces of peds; mildly alkaline, clear, smooth boundary.

IIC—46 to 60 inches, reddish-brown (5YR 4/4) silty clay; moderate, coarse, prismatic structure parting to weak to moderate, medium, angular blocky; firm; calcareous.

The A horizon ranges from loamy fine sand to fine sandy loam. Depth to the clayey material ranges from 20 to 40 inches The clayey material has a hue of 10YR to 5YR, and its texture is clay loam to clay.

Manistee soils are near Allendale and Wauseon soils. They form a drainage sequence with the somewhat poorly drained Allendale soils and the poorly drained Wauseon soils

Manistee loamy fine sand, 2 to 6 percent slopes (MeB).—This soil is on lacustrine plains. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of nearly level Manistee soils and areas of Manistee soils that are eroded.

Natural fertility and organic-matter content in this soil are low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Erosion is the main hazard on this soil, but moderate droughtiness also is a limitation.

Erosion-control practices help to reduce the hazard of erosion in areas planted to row crops. The soil is moderately well suited to crops commonly grown in the county. Capability unit IVs–3; woodland group 3; shrub and vine group A; wildlife group 3.

Manistee loamy fine sand, 6 to 14 percent slopes, eroded (MeC2).—This soil is on lacustrine plains and beach ridges. The surface layer is thinner and has a lighter color than the one in the profile described as representative of the series.

Included with this soil in mapping were areas of more steeply sloping Manistee soils and a few small areas of Manistee fine sandy loam.

Natural fertility and organic-matter content in this soil are low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. The hazard of further erosion is severe on this soil, and moderate droughtiness limits use.

Erosion-control practices are needed when the soil is planted to row crops. Most of the acreage is pasture, wooded areas, or idle grassland. Capability unit IVs–3; woodland group 3; shrub and vine group A; wildlife group 3.

Manistee fine sandy loam, 2 to 6 percent slopes (MfB).—This soil is on lacustrine plains. The sand content in the surface layer and in the upper part of the subsoil is lower than in the profile described as representative of the series.

Included with this soil in mapping were areas of nearly level Manistee soils and small areas of moderately eroded Manistee soils.

Natural fertility and organic-matter content in this

soil are low, and the effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. The soil is easy to cultivate. Erosion is the main hazard on this soil, but moderate droughtiness also is a limitation.

Erosion-control practices help to reduce the hazard of erosion in areas planted to row crops. The soil is moderately well suited to the crops commonly grown in the county. Capability unit IIIe–4; woodland group 3; shrub and vine group A; wildlife group 3.

Markey Series

The Markey series consists of moderately deep, very poorly drained organic soils that are in shallow glacial lake basins and depressions in stream valleys. These soils formed mainly in organic material derived from the decay of wetland grasses, sedges, and reeds. Slopes are 0 to 2 percent.

In a representative profile the surface layer is black muck about 14 inches thick. The next layer extends to a depth of about 27 inches and is black mucky peat. Below this is black muck which extends to a depth of about 35 inches. The underlying mineral material is grayish-brown medium sand.

Markey soils have high available water capacity and moderately rapid permeability. Reaction is medium acid to mildly alkaline.

Representative profile of Markey muck in a wooded area (SE¼SW¼ sec. 5, T. 25 N., R. 20 E., 300 feet north and 50 feet east of fire lane and town road intersection):

Oa1—0 to 14 inches, black (10YR 2/1) sapric material undisturbed or rubbed; 15 percent fibers undisturbed, less than 5 percent rubbed; moderate, medium, crumb structure; very friable; herbaceous fibers; sodium pyrophosphate test shows dark brown to brown (10YR 4/3); mildly alkaline; clear, wavy boundary.

Oa2—14 to 27 inches, black (10YR 2/1) sapric material undisturbed, very dark grayish brown (10YR 3/2) rubbed; about 25 percent fibers undisturbed, less than 10 percent rubbed; weak, medium, subangular blocky structure; slightly sticky; herbaceous fibers; sodium pyrophosphate test shows grayish brown (10YR 5/2); mildly alkaline; clear, wavy boundary

Oa3—27 to 35 inches, black (10YR 2/1) sapric material undisturbed or rubbed; about 10 percent fibers undisturbed, less than 5 percent rubbed; weak, medium, subangular blocky structure; slightly sticky; herbaceous fibers; sodium pyrophosphate test shows very dark grayish brown (10YR 3/2); mildly alkaline; abrupt, wavy boundary.

IIC—35 to 60 inches, grayish-brown (10YR 5/2) medium sand; single grain; nonsticky; mildly alkaline.

The organic material ranges from 16 to 50 inches in thickness but generally is 24 to 40 inches. The degree of decomposition of organic layers varies. The organic material has hues of 10YR or 7 5YR, values of 2 or 3, and chromas of 0 to 3 The IIC horizon has hues of 10YR or 2 5Y, values of 5 or 6, and chromas of 0 to 2. It is loamy sand, sand, or sand and gravel.

Markey soils are near Roscommon and Carbondale soils They have a thicker layer of organic material over sand than Roscommon soils, and they formed in thinner organic deposits than the Carbondale soils

Markey muck (0 to 2 percent slopes) (Mk).—This is the only Markey soil mapped in the county. It is in shallow glacial lake basins and depressions in stream valleys.

Included with this soil in mapping were a few soils that have slopes of 3 percent and a few small areas of Carbondale, Ogden, and Cathro soils.

Natural fertility in this soil is low, and organic-matter content is very high. Runoff is very slow, and wetness is a major hazard. Susceptibility to frost is also a management concern, and the high water table is a severe limitation for intensive use.

When the soil is used for crops, drainage measures and water-level control systems help to remove excess water, limit subsidence, and reduce the hazard of soil blowing. When water-control measures are established, this soil is moderately well suited to water-tolerant field and truck crops, but it is better suited to trees or wildlife habitat. This soil is unsuited to most engineering uses. Capability unit IVw–7; woodland group 10; shrub and vine group C; wildlife group 6.

Marsh

Marsh (Mr) is in depressions where drainage water accumulates and causes flooding. It occupies shallow lakes and ponds that are dry during years when rainfall is less than normal. Most areas, however, remain covered with water throughout the year.

Marsh is not suited to farm crops. It provides good habitat for ducks, geese, and other waterfowl and for muskrats, mink, and other fur-bearing animals. Cattails, rushes, sedges, willows, and other water-tolerant plants grow luxuriantly in Marsh areas and provide sanctuaries for wildlife. Capability unit VIIIw–15; woodland group 11; shrub and vine group D; wildlife group 6.

Menominee Series

The Menominee series consists of deep, well-drained soils on glacial till plains. These soils formed in a moderately thick sandy mantle and the underlying loam or sandy loam glacial till. Slopes are 2 to 6 percent.

In a representative profile the surface layer is brown to dark-brown loamy fine sand about 10 inches thick. The subsoil, which extends to a depth of about 35 inches, is strong-brown loamy fine sand in the upper part, reddish-brown sandy loam over yellowish-red clay loam in the middle part, and reddish-brown loam in the lower part. The substratum, to a depth of 60 inches, is reddish-brown sandy loam.

Menominee soils have moderate available water capacity and moderate permeability. Reaction is slightly acid to mildly alkaline.

Representative profile of Menominee loamy fine sand, 2 to 6 percent slopes, in a cultivated area (NE¼NW¼ sec. 6, T. 24 N., R. 20 E., 75 feet north of town road at field entrance):

Ap—0 to 10 inches, brown to dark-brown (10YR 4/3) loamy fine sand; moderate, medium, granular structure; very friable; many roots; neutral; clear, wavy boundary.

Bir—10 to 22 inches, strong-brown (7.5YR 5/8) loamy fine sand; moderate, medium, granular structure; loose; slightly acid; clear, wavy boundary.

I&IIB'21—22 to 29 inches, reddish-brown (5YR 4/4) sandy loam; moderate, medium, subangular blocky structure; firm; slightly acid; clear, irregular boundary.

IIB'22t—29 to 32 inches, yellowish-red (5YR 4/8) clay loam; weak, medium, subangular blocky structure; very firm; thin patchy clay films; slightly acid; abrupt, irregular boundary.

IIB'3—32 to 35 inches, reddish-brown (5YR 5/4) loam; weak, coarse, subangular blocky structure; firm; slightly acid; abrupt, irregular boundary.
IIC—35 to 60 inches, reddish-brown (5YR 5/4) sandy loam; massive; friable; calcareous

The solum ranges from 24 to 50 inches in thickness but is dominantly 27 to 40 inches. The sandy mantle ranges in thickness from 20 to 36 inches. The A1 horizon in uncultivated areas is very dark grayish brown (10YR 3/2) and is 1 to 6 inches thick. The A2 horizon has been mixed with the Ap horizon in cultivated areas It has weak platy structure The Bir horizon is sandy loam or loamy fine sand. The Bt horizon is sandy clay loam or clay loam, and the C horizon is loam or sandy loam.

Menominee soils are commonly associated with Onaway, Solona, and Angelica soils. They have a higher content of sand in the B horizon than Onaway soils and are better drained than the somewhat poorly drained Solona soils and the poorly drained Angelica soils

Menominee loamy fine sand, 2 to 6 percent slopes (MsB).—This soil is on glacial till plains. Included in mapping were small areas of sloping Menominee soils and many areas of soils that have a sandy loam surface layer.

Natural fertility and content of organic matter in this soil are low, and the effective depth to which roots can penetrate is 40 inches or more. Runoff is slow.

Erosion is the main hazard on this soil. The limited available water capacity and the low level of fertility are secondary limitations.

Good management practices that include erosion-control measures are important for cultivated crops. This soil is fairly well suited to crops commonly grown in the county. Capability unit IIIe–4; woodland group 4; shrub and vine group B; wildlife group 1.

Namur Series

The Namur series consists of well-drained soils on glacial till plains. These soils formed in a mantle of loamy material over limestone bedrock. They are very shallow over bedrock, and the bedrock has a strong influence on topography. Slopes range from 1 to 20 percent.

In a representative profile the surface laver is very dark brown silt loam about 6 inches thick. It is underlain by limestone bedrock. The upper few inches of the bedrock is fractured and breaks into flagstones of various sizes.

Namur soils have a very low available water capacity and moderate permeability. Reaction is mildly alkaline.

Representative profile of Namur silt loam, 1 to 6 percent slopes, in pasture (SW¼SE¼ sec. 14, T. 25 N., R. 22 E., 150 feet south of State Highway 57 and 75 feet west of public service road):

A1—0 to 6 inches, very dark brown (10YR 2/2) silt loam; weak, medium, subangular blocky structure parting to moderate, fine and medium, granular; very friable; many roots; dolomitic fragments up to 4 inches in diameter in places, mostly less than 1 inch; mildly alkaline; abrupt, wavy boundary.
IIR1—6 to 9 inches, bedded limestone flagstones ½ to 2 inches thick, 4 to 12 inches in diameter; horizontal and vertical fractures filled with A horizon material make up about 15 percent of horizon.
IIR2—9 to 60 inches, consolidated limestone bedrock.

Depth to bedrock ranges from 5 to 12 inches but is commonly less than 7 inches. The A horizon has hues of 10YR and 7.5YR, values of 2 or 3, and chromas of 1 to 3. A B horizon is present in areas where the depth to bedrock exceeds 7 inches.

Namur soils are associated with Namur, wet variant, soils and the somewhat poorly drained Bonduel soils. They also are adjacent to the deeper, well-drained Summerville soils.

Namur silt loam, 1 to 6 percent slopes (NaB).—This soil is on glacial till plains. It has the profile described as representative of the series. The underlying bedrock has a strong influence on topography.

Included with this soil in mapping were a few small areas of eroded Namur soils and some Namur soils that have a subsoil of thin silt loam or heavy silt loam.

Natural fertility in this soil is low, and organic-matter content is moderately low. The effective depth to which roots can penetrate is very shallow. Bedrock at a depth of less than 12 inches is the main limitation to use of this soil.

The soil is better suited to permanent pasture or trees than to other uses, and it is mostly used for these purposes. Capability unit VIs–5; woodland group 6; shrub and vine group B; wildlife group 8.

Namur silt loam, 6 to 20 percent slopes (NaD).—This soil is on glacial till plains where underlying bedrock has a strong influence on topography. Stones on the surface and exposures of limestone bedrock are more extensive, but the soil otherwise is similar to that described as representative of the series.

Included with this soil in mapping were areas of an eroded Namur soil and a few areas of Namur soils that have a subsoil of thin silt loam or heavy silt loam.

Natural fertility in this soil is low, and organic-matter content is moderately low. The effective depth to which roots can penetrate is very shallow. Limestone bedrock at a depth of less than 12 inches is the main limitation on this soil. The soil is better suited to permanent pasture or woodland, and it is mostly used for these purposes. Capability unit VIs–5; woodland group 6; shrub and vine group B; wildlife group 8.

Namur Series, Wet Variant

These variants from the normal Namur soils consist of very shallow, poorly drained soils in depressions on glacial till plains. They formed in a thin loamy mantle over limestone bedrock. The bedrock strongly influences topography. Slopes are 0 to 2 percent.

In a representative profile the surface layer is black silt loam about 6 inches thick. The subsoil is about 4 inches thick. The upper 2 inches of the subsoil is very dark grayish-brown silt loam with yellowish-brown mottles, and the lower 2 inches is yellowish-brown fine sandy loam with brownish-yellow mottles. Limestone bedrock is at a depth of about 10 inches.

Namur, wet variant, soils have a very low available water capacity and moderate permeability. Reaction is mildly alkaline to moderately alkaline.

Representative profile of Namur silt loam, wet variant (0 to 2 percent slopes), in a wooded lot (SE¼SE¼ NE¼ sec. 28, T. 25 N., R. 22 E., 40 feet west of road, 36 feet north of culvert):

A1—0 to 6 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; very friable; many roots; moderately alkaline; abrupt, smooth boundary.
B1g—6 to 8 inches, very dark grayish-brown (2.5Y 3/2) silt loam; common, medium and coarse, prominent, yel-

lowish-brown (10YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; very friable; many roots; moderately alkaline; abrupt, smooth boundary.

B2—8 to 10 inches, yellowish-brown (10YR 5/6) fine sandy loam; many, coarse, distinct, brownish-yellow (10YR 6/8) mottles; moderate, fine, subangular blocky structure; very friable; many roots; fragments of limestone 15 to 40 millimeters in diameter; mildly calcareous; abrupt, smooth boundary.

IIR—10 to 60 inches, limestone bedrock.

The solum is 5 to 10 inches deep over bedrock. The B horizon generally is absent where depth to bedrock is less than 8 inches.

Namur, wet variant soils are associated with Namur and Ruse soils. They are wetter than Namur soils and are shallower to bedrock than Ruse soils.

Namur silt loam, wet variant (0 to 2 percent slopes) (Ne).—This is the only variant from the normal Namur series mapped in the county. It is in depressions on glacial till plains.

Included with this soil in mapping were small areas of soils that are underlain by limestone at a depth of 10 to 20 inches. A few small areas of Namur soils were also included.

Natural fertility in this soil is low, and organic-matter content is medium. The effective depth to which roots can penetrate is very shallow.

This soil is wet, shallow to bedrock, and is poorly suited to crops. It is better suited to permanent pasture, trees, wildlife habitat, and recreational areas than to other uses. Capability unit VIs–5; woodland group 7; shrub and vine group C; wildlife group 5b.

Ogden Series

The Ogden series consists of very poorly drained organic soils that are moderately deep to clayey material. They are in shallow glacial lake basins and other depressions.

In a representative profile the surface layer is black muck about 17 inches thick. The next layer, which extends to a depth of about 28 inches, is black mucky peat. The third layer extends to a depth of 32 inches. It is very dark gray sedimentary peat that has a gelatinous appearance when moist. The substratum, to a depth of 38 inches, is gray silty clay loam. Below this, to a depth of 60 inches, it is reddish-gray silty clay.

Ogden soils have very high available water capacity. Permeability is moderately rapid in the organic part and slow in the underlying clayey substratum. Reaction is neutral to mildly alkaline.

Representative profile of Ogden muck (0 to 2 percent slopes) in an area of pasture (SW¼NW¼ sec. 29, T. 24 N., R. 22 E., 350 feet east of road near fence line):

Oa1—0 to 10 inches, black (10YR 2/1) sapric material undisturbed or rubbed; 10 percent fibers undisturbed, 2 percent rubbed; moderate-to-strong, medium, crumb structure; very friable; sodium pyrophosphate test shows brown to dark brown (10YR 4/3); herbaceous fibers; neutral; clear, wavy boundary.

Oa2—10 to 17 inches, black (10YR 2/1) sapric material undisturbed or rubbed; 10 percent fibers undisturbed, 2 percent rubbed; weak, medium and fine, subangular blocky structure; friable; sodium pyrophosphate test shows brown to dark brown (10YR 4/3); herbaceous fibers; neutral; abrupt, wavy boundary.

Oe—17 to 28 inches, black (10YR 2/1) hemic material undisturbed, very dark brown (10YR 2/2) rubbed; 65 percent fibers undisturbed, 20 percent rubbed; weak, coarse, platy structure; friable; sodium pyrophosphate test shows very pale brown (10YR 7/3); herbaceous fibers; neutral; abrupt, wavy boundary.

Lco—28 to 32 inches, very dark gray (5Y 3/1) coprogenous material (sedimentary peat) undisturbed or rubbed; less than 10 percent fibers; gelatinous in places parting to weak, fine, platy structure; slightly sticky when wet; sodium pyrophosphate test shows no color; thin gray mineral strata less than 1 centimeter thick; neutral; abrupt, wavy boundary.

IIC1—32 to 38 inches, gray (5Y 5/1) silty clay loam; many, coarse, prominent, light olive-brown (2.5Y 5/4) mottles; massive; very sticky when wet; mildly alkaline; gradual, irregular boundary.

IIC2—38 to 60 inches, reddish-gray (5YR 5/2) silty clay; common, medium, distinct, reddish-brown (5YR 5/4) mottles; massive; very sticky when wet; calcareous.

The organic material ranges from 16 to 50 inches in thickness in undrained areas. The degree of decomposition of the organic material varies. The Oa layers are highly decomposed, and the Oe layer is less so. The Oa layers commonly are very dark gray to black, mainly because of oxidation and humification The Oe layer ranges from black to dark grayish brown to dark reddish brown. If present, the Lco layer generally is in the lower part of the organic material. The IIC horizon is sandy clay, silty clay, clay, heavy silty clay, or heavy clay loam.

The Ogden soils, as mapped in Brown County, have a hemic layer that is slightly thicker than is defined for the series, but this does not alter their usefulness and behavior.

Ogden soils are near Carbondale, Poygan, and Cathro soils. Unlike the Carbondale soils, they are only moderately deep over a clayey substratum They lack a loamy substratum like that of the Cathro soils, and they lack a clayey solum like that of the Poygan soils.

Ogden muck (0 to 2 percent slopes) (Od).—This is the only Ogden soil mapped in the county. It is in shallow glacial lake basins and other depressions.

Included with this soil in mapping are some small areas of Poygan and Carbondale soils and areas of soils that have less decomposed organic layers than this soil.

Natural fertility in this soil is low, and organic-matter content is very high. Runoff is very slow. Wetness is the chief limitation to use of this soil. The soil subsides when drained and becomes very susceptible to soil blowing. Frost is sometimes a hazard to crops.

Undrained areas generally are in pasture or trees. Drained areas are often used for truck crops or sod. Capability unit IIIw–8; woodland group 10; shrub and vine group C; wildlife group 6.

Onaway Series

The Onaway series consists of deep, well-drained soils on glacial till plains and ridges. These soils formed in loam or sandy loam glacial till. Slopes are 0 to 20 percent.

In a representative profile the surface layer is very dark grayish-brown loam about 4 inches thick. The subsurface layer is grayish-brown fine sandy loam about 2 inches thick. The subsoil extends to a depth of about 27 inches. The upper part is brown to dark-brown fine sandy loam, and the middle part is dark reddish-brown clay loam with light reddish-brown fine sandy loam coatings. The lower part is reddish-brown clay loam. The substratum, to a depth of 60 inches, is reddish-brown sandy loam.

Onaway soils have high available water capacity and moderate permeability. Reaction is slightly acid to mildly alkaline.

Representative profile of Onaway loam, 0 to 2 percent slopes, in an area of idle land (SE¼NE¼ sec. 21, T. 25 N., R. 19 E., 400 feet northwest of the east-to-west road, on the northeast bank):

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, granular structure; very friable; many roots; mildly alkaline; abrupt, wavy boundary.

A2—4 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam; weak, fine, platy structure parting to weak, very fine, subangular blocky, very friable, many roots; mildly alkaline; abrupt, wavy boundary

Bir—6 to 13 inches, brown to dark-brown (7.5YR 4/4) fine sandy loam; weak, medium, subangular blocky structure parting to moderate, fine, crumb; very friable; few roots; slightly acid; clear, irregular boundary.

B'+A'—13 to 17 inches, dark reddish-brown (5YR 3/4) clay loam that has light reddish-brown (5YR 6/3) fine sandy loam coatings enclosing peds, moderate, medium and coarse, subangular blocky structure; friable when moist, hard when dry; rock fragments less than 5 millimeters in diameter; few roots; neutral; clear, wavy boundary

B'2t—17 to 23 inches, reddish-brown (5YR 4/4) clay loam, strong, medium and coarse, subangular blocky structure; firm when moist, very hard when dry; rock fragments less than 5 millimeters in diameter; thin patchy clay films; few roots; moderately alkaline; clear, wavy boundary.

B'3t—23 to 27 inches, reddish-brown (5YR 4/4) light clay loam; moderate, medium, subangular blocky structure; friable when moist, hard when dry; rock fragments 3 millimeters to 1 inch in diameter; medium, continuous clay films; few roots; calcareous; clear, wavy boundary.

C—27 to 60 inches, reddish-brown (5YR 5/4) sandy loam; massive, friable when moist, hard when dry; rock fragments 3 millimeters to 5 inches in diameter; calcareous.

The solum commonly is 24 to 30 inches thick but ranges from 20 to 36 inches The A1 horizon ranges to very dark brown in color and to 5 inches in thickness Texture ranges from loam to sandy loam The C horizon is sandy loam or loam. It contains pockets or lenses of loamy sand or sand and gravel in some areas Fragments of limestone are present throughout the profile in many areas

Onaway soils are near Solona, Angelica, and Menominee soils. They are better drained than Solona or Angelica soils, and they have a higher content of clay throughout the solum than Menominee soils.

Onaway sandy loam, 2 to 6 percent slopes (OeB).—This soil is in areas on glacial till plains. The content of sand in the surface layer is greater than that in the profile described as representative of the series.

Included with this soil in mapping were a few areas of eroded Onaway soils and small areas of somewhat poorly drained Solona soils that are in depressions and drainageways.

Natural fertility in this soil is medium, and the content of organic matter is low. Runoff is medium. The effective depth to which roots can penetrate is 40 inches or more. Erosion is the main hazard on this soil.

Erosion-control measures and other good management practices are beneficial in areas that are farmed intensively. This soil is well suited to all crops commonly grown in the county. Capability unit IIe–2; woodland group 1; shrub and vine group A; wildlife group 1.

Onaway sandy loam, 6 to 12 percent slopes, eroded (OeC2).—This soil is on glacial till plains. It has a surface layer that is thinner, lighter colored, and more sandy than the one in the profile described as representative of the series.

Included with this soil in mapping were a few areas of slightly eroded, gently sloping and moderately steep Onaway soils, small areas of Onaway soils that have a loam surface layer, and a few areas of soils that have more than 20 inches of sand over glacial till. Some Solona soils in narrow drainageways were also included.

Natural fertility in this soil is medium. Organic-matter content is low, and runoff is medium to rapid. The effective depth to which roots can penetrate is 40 inches or more. This soil is subject to further erosion when it is farmed intensively.

Erosion-control measures are helpful in reducing the amount of soil loss. The soil is suited to most crops commonly grown in the county. Capability unit IIIe–2; woodland group 1; shrub and vine group A; wildlife group 1.

Onaway loam, 0 to 2 percent slopes (OhA).—This soil is on glacial till plains. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of somewhat poorly drained Solona soils in depressions and drainageways and some small areas of gently sloping Onaway soils.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Early frost is the main limitation to use of this soil for crops.

This soil can be farmed intensively where fertility is maintained, and it is well suited to all crops commonly grown in the county. Capability unit IIs–1; woodland group 1; shrub and vine group A; wildlife group 1.

Onaway loam, 2 to 6 percent slopes (OhB).—This soil is on glacial till plains. The thickness of the surface layer and subsoil combined is less than that in the profile described as representative of the series.

Included with this soil in mapping were some small areas of somewhat poorly drained Solona soils in drainageways and small depressions. Small areas of eroded Onaway soil were also included.

Natural fertility in this soil is medium. Organic-matter content is low, and runoff is medium. The effective depth to which roots can penetrate is 40 inches or more. Erosion and early frost are the main hazards to crops.

Erosion control helps to prevent loss of soil material where the soil is farmed intensively. This soil is well suited to all crops commonly grown in the county. Capability unit IIe–2; woodland group 1; shrub and vine group A; wildlife group 1.

Onaway loam, 12 to 20 percent slopes, eroded (OhD2).—This soil is on ridges in glacial till plains. The surface layer and subsoil are thinner than those in the profile described as representative of the series, and the surface layer is lighter colored.

Included with this soil in mapping were a few areas of Onaway soils that have a surface layer of sandy loam, areas of severely eroded Onaway soils, and a few areas of sloping and steep Onaway soils.

Natural fertility in this soil is medium, and organic-matter content is low. Runoff is medium to rapid. The effective depth to which roots can penetrate is 40 inches or more. The main hazard on this soil is further erosion. The moderately steep slopes limit cultivation.

Erosion control helps to reduce the amount of soil loss where the soil is planted to row crops.

Most of the acreage is used for woodland or permanent pasture. Capability unit IVe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Onaway-Solona complex, 2 to 6 percent slopes (OlB).—These soils are on loamy glacial till plains. About 60 percent of the complex is Onaway loam, and about 35 percent is Solona loam. The other 5 percent is mainly Angelica silt loam. Onaway soils in this complex are steeper than the Solona soils which are in depressions and drainageways. Small areas of poorly drained Angelica soils also are in depressions.

The Onaway and Solona soils have profiles similar to those described as representative of their respective series. The surface layer of both of these soils is mainly loam, but a few areas of Onaway and Solona soils that have surface layer of sandy loam were included in mapping.

Runoff is slow to medium. Erosion is the main hazard on Onaway soils, and wetness is the main hazard on Solona soils.

Most of the acreage in this complex is cultivated. Uncultivated areas generally are Solona soils, and they are used for pasture. Random tile drainage systems on Solona soils help to remove excess water in cultivated areas. If Solona soils are drained, this complex is suited to most crops grown in the county. Capability unit IIe–2; woodland group 1; shrub and vine group A; wildlife group 1.

Oshkosh Series

The Oshkosh series consists of deep, well drained and moderately well drained soils on lacustrine plains dissected by V-shaped valleys. These soils formed under mixed hardwoods in a thin silt mantle and underlying clayey lacustrine sediment. Slopes are 0 to 30 percent.

In a representative profile the surface layer is dark-gray to very dark grayish-brown silt loam about 4 inches thick. The subsurface layer is weak red silt loam about 3 inches thick. The subsoil is about 22 inches thick. The upper 2 inches is dark reddish-gray to reddish-gray silty clay, and the lower 20 inches is a reddish-brown silty clay. The upper 2 inches of the substratum is reddish-brown silty clay loam, and the lower part is reddish-brown silty clay.

Oshkosh soils have medium available water capacity and are slowly permeable. Reaction is medium acid to neutral.

Representative profile of Oshkosh silt loam, 2 to 6 percent slopes (T. 23 N., R. 20 E., Public Claim 25, ¼ mile west of Highway 32–41, 125 yards south of County Highway HH, and 50 feet east of town road):

A1—0 to 4 inches; very dark gray (10YR 3/1) to very dark grayish-brown (10YR 3/2) silt loam; weak, fine, subangular blocky structure; very friable; neutral; abrupt, smooth boundary

A2—4 to 7 inches; weak-red (2.5YR 5/2) silt loam; weak, fine, platy structure; friable, slightly acid; abrupt, wavy boundary.

B21t—7 to 9 inches; dark reddish-gray (5YR 4/2) to reddish-brown (5YR 4/3) silty clay; moderate, coarse, platy structure parting to moderate, medium, subangular blocky; firm; nearly continuous clay films; bleached silt coatings on major vertical cleavage planes; slightly acid; abrupt, smooth boundary.

B22t—9 to 17 inches, reddish-brown (2.5YR 4/4) silty clay, moderate, fine and very fine, subangular blocky structure; firm; continuous clay films; medium acid; clear, smooth boundary.

B23t—17 to 29 inches; reddish-brown (5YR 4/3) silty clay; moderate, fine, angular and subangular blocky structure; firm; continuous clay films; slightly acid, abrupt, smooth boundary.

C1—29 to 31 inches; reddish-brown (5YR 4/3) silty clay loam; weak, fine and medium, subangular blocky structure; friable; thin lenses of silty sediment; strongly calcareous; abrupt, smooth boundary.

C2—31 to 60 inches; reddish-brown (5YR 5/3) silty clay; weak, fine and medium, subangular blocky structure; firm; bleached silt coats on faces of peds; strongly calcareous.

The solum generally is 24 to 30 inches thick but is 18 to 30 inches in places. A loamy mantle up to 10 inches thick is commonly present The A1 horizon has a hue of 10YR, a value of 2 or 3, and a chroma of 1, 2, or 3 Where cultivated, the Ap horizon generally has a value of 4. Texture is sandy loam, silt loam, or silty clay loam. The A2 horizon, where not incorporated with the plow layer through cultivation, has a texture similar to that of overlying horizons but with higher values Clay films are patchy to continuous Soft lime segregations are present in places Thin strata of fine sand, silt, silty clay loam, or loam occur in places in the C horizon.

Oshkosh soils are near Briggsville, Manawa, and Poygan soils. They have a more clayey B horizon than Briggsville soils Oshkosh soils form a drainage sequence with the somewhat poorly drained Manawa soils and the poorly drained Poygan soils.

Oshkosh sandy loam, 0 to 2 percent slopes (OmA).—This soil is on old glacial lake basins. The surface layer has a higher sand content, but the profile otherwise is similar to that described as representative of the series. The surface layer in cultivated areas is lighter in color than that in undisturbed areas.

Included with this soil in mapping were a few small areas of somewhat poorly drained Manawa soils in low-lying areas and shallow drainageways.

Natural fertility of this soil is high, and organic-matter content is low. Runoff is slow. The effective depth to which roots can penetrate is 40 inches or more. Growth of shallow-rooted crops is retarded during dry periods.

The soil is well suited to all crops commonly grown in the county. Capability unit IIs–7; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh sandy loam, 2 to 6 percent slopes (OmB).—This soil is in old glacial lake basins. It has a surface layer that has a higher sand content and a lighter color than the one in the profile described as representative of the series.

Included with this soil in mapping were some areas of eroded Oshkosh soils and a few small areas of somewhat poorly drained Manawa soils in low-lying areas or in shallow drainageways.

Natural fertility in this soil is high, and organic-matter content is low. Runoff is slow. The effective depth to which roots can penetrate is 40 inches or more. Erosion is the main hazard on this soil. The growth of shallow-rooted crops is sometimes retarded during dry periods.

Erosion-control practices are beneficial when this soil is planted to row crops. This soil is well suited to all of the crops commonly grown in this county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silt loam, 0 to 2 percent slopes (OnA).—This soil is in old glacial lake basins. The surface layer is thicker than the one in the profile described as representative of the series.

Included with this soil in mapping were a few small areas of somewhat poorly drained Manawa soils in low-lying areas and small areas of gently sloping Oshkosh soils.

The natural fertility level in this soil is high, and the organic-matter content is low. Runoff is slow. The effective depth to which roots can penetrate is 40 inches or more.

Good seedbeds are difficult to establish if the soil is plowed when too wet.

Good management practices, such as plowing under green manure, help to maintain good tilth. This soil is well suited to all of the crops commonly grown in the county. Capability unit IIs–7; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silt loam, 2 to 6 percent slopes (OnB).—This soil is in old glacial lake basins. It has the profile described as representative of the series.

Included with this soil in mapping were a few areas of eroded Oshkosh soils and a few small, low areas of somewhat poorly drained Manawa soils.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow to medium. Preparing a good seedbed is difficult if this soil is plowed when too wet. Erosion of this soil is the main hazard.

If lime and fertilizer are applied, green-manure crops are grown, and other good management practices are used, this soil is well suited to all the crops commonly grown in the county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silt loam, 6 to 12 percent slopes, eroded (OnC2).—This soil is in glacial lake basins. The surface layer and subsoil are thinner, but the profile otherwise is similar to the one described as representative of the series. In many places tillage has mixed material from the upper part of the subsoil into the original surface layer.

Included with this soil in mapping were a few areas of slightly eroded Oshkosh soils and a few small areas of somewhat poorly drained Manawa soils in low areas and drainageways.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. Further erosion is the main hazard, and loss of material from the surface soil layer results in poor tilth.

Contour strips, terraces, grass waterways, and other erosion-control practices are needed; and the use of green manure improves tilth. This soil is well suited to all crops commonly grown in the county. Capability unit IIIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silt loam, 12 to 20 percent slopes, eroded (OnD2).—This soil is on sides of narrow valleys in glacial lake basins. The surface layer and subsoil are thinner, but the profile otherwise is similar to that described as representative of the series. The upper part of the subsoil and the original surface layer have been mixed by tillage.

Included in mapping were some small areas of sloping Oshkosh soils and some small areas of somewhat poorly drained Manawa soils.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. The hazard of further erosion is severe.

Much of the acreage of this soil is in pasture or is wooded. Capability unit IVe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silt loam, 20 to 30 percent slopes, eroded (OnE2).—This soil is on sides of narrow valleys in glacial lake basins. It has a profile similar to the one described as representative of the series, but the surface layer and subsoil are thinner.

Included with this soil in mapping were spots of severely eroded Oshkosh soils and small areas of somewhat poorly drained Manawa soils.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is rapid. The hazard of further erosion is severe.

Most of the acreage of this soil is in pasture or trees. Capability unit VIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silt loam, loamy substratum, 2 to 6 percent slopes (OoB).—This soil is in glacial lake plains. It is underlain by stratified silt, very fine sand, or fine sand at a depth of 40 to 60 inches. In a few areas the subsoil contains some limestone and a few fragments of granite. Otherwise the profile of this soil is similar to that described as representative of the series.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Erosion is the main limitation to use of this soil. The surface layer is subject to clodding if it is tilled when wet.

Turning under green manure and using other erosion-control practices helps to maintain good tilth and reduce erosion when the soil is planted to row crops. This soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silty clay loam, 0 to 2 percent slopes (OsA).—This soil is in old glacial lake basins. It has a profile similar to the one described as representative of the series, but the surface layer has a higher clay content.

Included with this soil in mapping were some small areas of moderately well drained and somewhat poorly drained Manawa soils in low-lying areas.

Natural fertility in this soil is high, and organic-matter content is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Because of the silty clay loam surface layer, this soil is often difficult to work. Clodding occurs if the soil is worked when wet.

The soil is well suited to all crops commonly grown in the county. Capability unit IIs–7; woodland group 2; shrub and vine group A; wildlife group 2.

Oshkosh silty clay loam, 2 to 6 percent slopes (OsB).—This soil is in old glacial lake basins. The surface layer has a higher clay content, but the profile otherwise is similar to that described as representative of the series.

Included with the soil in mapping were a few areas of eroded Oshkosh soils, a few small areas of moderately well drained soils, and somewhat poorly drained Manawa soils in low-lying areas and shallow drainageways.

Because of the silty clay loam texture of the surface layer, this soil is difficult to work. It has a tendency to form clods if worked when wet. This soil is susceptible to erosion. Erosion control is beneficial where this soil is planted to row crops. The soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; woodland group 2; shrub and vine group A; wildlife group 2.

Pella Series

The Pella series consists of deep, poorly drained soils in depressions on glacial till plains. These soils formed in a silt mantle and underlying calcareous, loam glacial till. Slopes are 0 to 2 percent.

In a representative profile the surface layer is black silt loam about 12 inches thick. The subsoil, extending to a depth of 38 inches, is dark-gray silt loam with yellowish-brown mottles in the upper part and gray silty clay loam with strong-brown mottles in the lower part. The substratum, to a depth of 60 inches, is brown and yellowish-brown loam.

Pella soils have high available water capacity and moderate to moderately slow permeability. Reaction is neutral to moderately alkaline.

Representative profile of Pella silt loam (0 to 2 percent slopes) in hayland (NE¼NW¼NE¼ sec. 12, T. 21 N., R. 20 E., 100 feet south of State Highway 96, and 25 feet west of field ditch):

A1—0 to 12 inches, black (10YR 2/1) silt loam; moderate, medium and fine, subangular blocky structure; friable; many roots; mildly alkaline; gradual, smooth boundary.

B1g—12 to 19 inches, dark-gray (5Y 4/1) silt loam; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; moderate, coarse, subangular blocky structure; friable; many roots; moderately alkaline; clear, smooth boundary.

B2g—19 to 33 inches, gray (5Y 5/1) silty clay loam; few, fine, prominent, strong-brown (7.5YR 5/8) mottles; moderate, fine, subangular blocky structure; friable; moderately alkaline; clear, smooth boundary.

B3g—33 to 38 inches, gray (5Y 5/1) light silty clay loam that contains grit; few, fine, prominent, strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; friable; calcareous; clear, smooth boundary.

C—38 to 60 inches; brown (10YR 5/3) and yellowish-brown (10YR 5/6) loam; massive; friable; calcareous.

The solum ranges from 24 to 42 inches in thickness but generally is 30 to 42 inches. In most places the solum formed in a silt mantle less than 40 inches thick and is underlain by loamy glacial till. The A1 horizon ranges from 10 to 20 inches in thickness and is black (10YR 2/1) to very dark gray (10YR 3/1) in color. The B horizon most commonly is gray (10YR 5/1 and 5Y 5/1) to light gray (10YR 7/1 and 5Y 7/1) and has brownish mottles. The B2g horizon is light silty clay loam or silty clay loam.

Pella soils are associated with Lamartine, Keowns, and Yahara soils They have a higher clay content in the B horizon than Keowns or Yahara soils, and they are wetter than Yahara and Lamartine soils.

Pella silt loam (0 to 2 percent slopes) (Pe).—This soil is in depressions on glacial till plains. Included in mapping were areas of somewhat poorly drained Lamartine soils and very poorly drained Cathro soils.

Natural fertility and organic-matter content in this soil are high. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Wetness is the main limitation to use. Drainage helps to remove excess water, and drained areas are suited to most crops commonly grown in the county. Most undrained areas are in permanent pasture or trees. Capability unit IIw–1; woodland group 7; shrub and vine group C; wildlife group 5b.

Poygan Series

The Poygan series consists of deep, poorly drained soils in depressions on glacial till plains or lacustrine plains. These soils formed in a thin silt mantle and underlying lacustrine or glacial till deposits. Slopes are 0 to 2 percent.

In a representative profile the surface layer is black silty clay loam about 7 inches thick. The subsoil extends to a depth of 24 inches. The upper part is very dark gray clay with yellowish-brown mottles. The lower part is reddish-brown clay with dark-gray, gray, and yellowish-red mottles. The substratum, to a depth of 60 inches, is reddish-brown, calcareous clay with yellowish-red mottles.

Poygan soils have medium available water capacity. Permeability is very slow. Reaction is slightly acid to mildly alkaline.

Representative profile of Poygan silty clay loam (NW¼NW¼ sec. 20, T. 21 N., R. 20 E., 120 feet south and 30 feet east of NW section corner intersection):

A1—0 to 7 inches, black (10YR 2/1) silty clay loam; moderate, fine, subangular blocky structure; friable; many roots; slightly acid; abrupt, wavy boundary.

B1g—7 to 12 inches, very dark gray (5YR 3/1) clay; many, medium, prominent, yellowish-brown (10YR 5/8) mottles; moderate to strong, medium, blocky structure; very firm; many roots; slightly acid; clear, wavy boundary.

B2—12 to 17 inches, reddish-brown (5YR 4/3) clay; many, medium, distinct, dark-gray (5YR 4/1) and many, medium, prominent, yellowish-red (5YR 4/8) mottles; moderate, medium, blocky structure; very firm; many roots in upper 2 inches; neutral; clear, wavy boundary.

B3—17 to 24 inches, reddish-brown (5YR 4/3) clay; few, medium, prominent, yellowish-red (5YR 4/8) and many, coarse, distinct, gray (5YR 5/1) mottles; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; firm; mildly alkaline; abrupt, wavy boundary.

C—24 to 60 inches, reddish-brown (5YR 4/3) clay; few, fine, prominent, yellowish-red (5YR 4/8) mottles; weak, medium, platy structure; firm; light-gray (5YR 7/1) free carbonates along horizontal cleavage faces; calcareous.

The thickness of the solum and the depth to free carbonates ranges from 20 to 30 inches. In places the soil in uncultivated areas has a thin, organic surface layer The A horizon typically is black (10YR 2/1), but in places the Ap horizon is very dark gray (10YR 3/1). Mottles in the B2 horizon range from few to many. The B horizon is silty clay or clay. It is 40 to 70 percent clay and 5 to 10 percent sand The C horizon is 40 to 60 percent clay and in places contains thin layers of silt and very fine sand.

Poygan soils are near Kewaunee, Manawa, Oshkosh, and Ogden soils They are wetter than Kewaunee, Oshkosh, and Manawa soils, and they lack the thick organic horizons of the Ogden soils.

Poygan silty clay loam (0 to 2 percent slopes) (Po).—This is the only Poygan soil mapped in the county. It is in depressions on glacial till or lacustrine plains.

Included with this soil in mapping were many small areas of soils that have a surface layer of silt loam.

Natural fertility and organic-matter content in this soil are high. Runoff is very slow, and wetness is the main limitation to use.

Tile drains are suitable; and if this soil is drained, it is suited to crops. Because of the heavy texture of the soil, it is important that tillage operations take place when the moisture content is at optimum level. Undrained areas generally are in woods or pasture. Capability unit IIw–1; woodland group 7; shrub and vine group C; wildlife group 5b.

Quarries

Quarries (Qu) are areas where bedrock has been removed for various purposes. The areas range from 2 to about 40 acres in size, and they are mainly along the Niagara escarpment.

Operations have ceased in many of the quarries in the county, and the abandoned quarries are used for recreational purposes or for wildlife habitat. Wildlife group 8; not placed in a capability unit, woodland group, or shrub and vine group.

Rodman Series

The Rodman series consists of well-drained to excessively drained, hilly to steep soils in moraınic topography. These soils are less than 10 inches thick over sand and gravel. They formed from calcareous sand and gravel. Slopes range from 12 to 35 percent.

In a representative profile the surface laver is very dark grayish-brown loam about 4 inches thick. The subsoil is brown to dark-brown loam, which extends to a depth of 8 inches. The substratum, to a depth of 60 inches, is very pale brown sand and gravel.

Permeability is moderate above the substratum and very rapid in the substratum. Rodman soils have a very low available water capacity. Reaction is neutral to moderately alkaline.

Representative profile of Rodman loam from an area of Casco-Rodman complex, 12 to 35 percent slopes, eroded, in a woodlot (SE¼NE¼ sec. 34, T. 25 N., R. 22 E., 0.25 mile west and 500 yards south of northeast section corner):

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, granular structure; very friable; many roots; common pebbles 15 millimeters in diameter; mildly alkaline; clear, wavy boundary.

B2—4 to 8 inches, brown to dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure; very friable; many roots; common pebbles 15 millimeters in diameter; mildly alkaline; clear, wavy boundary.

C—8 to 60 inches, very pale brown (10YR 7/4) sand and gravel; single grain; loose; calcareous.

The A horizon is very dark grayish-brown (10YR 3/2) or very dark brown (10YR 2/2) loam, gravelly loam, or sandy loam. In the B horizon hue is 7.5YR or 10YR, value is 4 or 5, and chroma is 3 or 4 It is loam, gravelly loam, or gravelly sandy loam. The C horizon is sand and gravel, and 75 to 85 percent of the gravel is derived from local limestone. In this horizon hue is 10YR; value is 5, 6, or 7; and chroma is 3 or 4.

Rodman soils are mapped only in a complex with Casco soils.

Roscommon Series

The Roscommon series consists of deep, poorly drained soils in depressions on sandy lacustrine and outwash plains. These soils formed under water-tolerant grasses and shrubs. Slopes are 0 to 2 percent.

In a representative profile black muck about 5 inches thick is on the surface, and below it is black loamy fine sand about 3 inches thick. The substratum, immediately below the loamy fine sand, is dark grayish-brown to dark-gray fine sand with yellowish-red mottles to a depth of 19 inches. Below this, to a depth of 60 inches, it is brown medium sand.

Roscommon soils have a low available water capacity and rapid permeability. Reaction is neutral to slightly acid.

Representative profile of Roscommon loamy fine sand (0 to 2 percent slopes) in a wooded stream valley (SE¼ SW¼ sec. 5, T. 25 N., R. 20 E., 825 yards east of southwest section corner, 50 feet northwest of township road):

Oa—5 to 0 inches, black (5YR 2/1) muck; 10 percent fibers undisturbed, less than 5 percent rubbed; weak, medium, granular structure; very friable; many roots; neutral; abrupt, wavy boundary.

A1—0 to 3 inches, black (10YR 2/1) loamy fine sand; moderate, medium, crumb structure; very friable; many roots; neutral; clear, irregular boundary.

C1g—3 to 5 inches, dark grayish-brown (10YR 4/2) to dark-gray (10YR 4/1) fine sand; few, medium, prominent, yellowish-red (5YR 5/6) mottles; single grain; nonsticky; many roots; neutral; abrupt, wavy boundary.

C2g—5 to 19 inches, dark grayish-brown (10YR 4/2) fine sand; common, medium, prominent, yellowish-red (5YR 5/6) mottles single grain; nonsticky; slightly acid; gradual, wavy boundary.

C3—19 to 60 inches, brown (10YR 5/3) medium sand; single grain; nonsticky; slightly acid.

The A horizon ranges from 3 to 8 inches in thickness A muck layer up to 6 inches thick is on the surface in places. The C horizon commonly has hues of 10YR or 7 5 YR, values of 4 or 5, and chromas of 2 or 3. The abundance of mottling in the C horizon varies Thin layers of sandy loam or light sandy clay loam are in the C horizon in places.

Roscommon soils are near Shawano, Tedrow, and Markey soils. They are wetter than Shawano and Tedrow soils and do not have so thick an organic layer as Markey soils.

Roscommon loamy fine sand (0 to 2 percent slopes) (Rs).—This soil is in depressions on sandy lacustrine and outwash plains. It has the profile described as representative of the series.

Included with this soil in mapping were areas of Roscommon soil that has a surface layer of light sandy loam. Also included were small areas of Tedrow and Markey soils.

Natural fertility in this soil is low, and the content of organic matter is high. The effective depth to which roots can penetrate is 40 inches or more. Runoff is very slow. The high water table and low fertility level in this soil make it poorly suited to crops.

Open ditches help to drain off excess water. Most areas are planted to water-tolerant trees, shrubs, and grasses. Capability unit IVw–5; woodland group 8; shrub and vine group C; wildlife group 5b.

Rough Broken Land

Rough broken land (30 to 45 percent slopes, eroded) (Ro) is on steep sides of rivers, streams, and gullies. It

generally is in long, narrow areas on uniform, concave slopes. The soil material is reddish-brown heavy clay loam, silty clay, clay glacial till, or lacustrine sediment. Rapid and continuous geologic erosion has removed soil material from this land type faster than a profile could be established.

Organic-matter content and available water capacity are low. Reaction is mildly alkaline to calcareous.

Runoff is very rapid, and the hazards of erosion and slippage are very severe. Vegetation generally consists of native grasses and weeds.

Rough broken land is used mainly for wildlife habitat, trees, pasture, or recreation. Capability unit VIIe–6; woodland group 1; shrub and vine group A; wildlife group 8.

Ruse Series

The Ruse series consists of poorly drained soils that are shallow over limestone bedrock. The underlying bedrock strongly influences the topography. These soils are in depressions. Slopes are 0 to 2 percent.

In a representative profile black muck about 4 inches thick is on the surface. The surface mineral layer is very dark brown silt loam about 3 inches thick. The subsoil extends to a depth of about 19 inches. It is grayish-brown heavy loam with light olive-brown mottles in the upper part, grayish-brown clay loam with yellowish-brown mottles in the middle part, and brown heavy loam with strong-brown mottles in the lower part. Limestone bedrock is at a depth of about 19 inches.

Ruse soils generally have a low available water capacity. The available water capacity varies because of the variable depth to bedrock. Permeability above the bedrock is moderate. Reaction is slightly acid to mildly alkaline.

Representative profile of Ruse silt loam (0 to 2 percent slopes) in pasture (NW¼NE¼SW¼, sec. 8, T. 24 N., R. 22 E., about 235 feet south of road and 3 feet west of fence line):

O1—4 inches to 0, black (10YR 2/1) muck; moderate, medium, granular structure; very friable; many roots; mildly alkaline; abrupt, smooth boundary.

A1—0 to 3 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, subangular blocky structure; friable; many roots; neutral; clear, wavy boundary.

B21g—3 to 7 inches, grayish-brown (2.5Y 5/2) heavy loam; few, fine, prominent, light olive-brown (2.5Y 5/6) mottles; moderate medium, subangular blocky structure; friable; few roots; mildly alkaline; clear, wavy boundary.

B22g—7 to 14 inches, grayish-brown (2.5Y 5/2) clay loam; moderate, medium, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; mildly alkaline; gradual, irregular boundary.

B3—14 to 19 inches, brown (10YR 5/3) heavy loam; moderate, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, coarse, subangular blocky structure; firm; mildly alkaline; abrupt, smooth boundary.

IIR—19 to 60 inches, consolidated limestone bedrock.

Depth to bedrock ranges from 10 to 20 inches but generally is 16 to 20 inches. The A horizon is silt loam or loam, and the B2 horizon is clay loam or heavy loam. The B horizon has hues of 10YR or 7.5 YR. The Bg horizon has values of 4 through 6 and chromas of 1 or 2. The B3 horizon has values of 4 through 6 and chromas of 1 through 4. Mottles of high and low chroma occur throughout the B horizon, but high-chroma mottles are dominant.

Ruse soils are commonly associated with Namur, wet variant, and Summerville, clayey subsoil variant, soils. They have a darker colored A horizon and more mottles than Summerville, clayey subsoil variant, soils. They are deeper to bedrock than Namur, wet variant, soils.

Ruse silt loam (0 to 2 percent slopes) (Ru).—This soil is in depressions. It has the profile described as representative of the series.

Included with this soil in mapping were a few areas of Ruse soils that have a loam surface layer, small areas where depth to bedrock is less than 10 inches or is greater than 20 inches, and areas of Bonduel soils.

The fertility level of this soil is variable because of the range of depth to bedrock. Bedrock also limits the depth of root penetration. The soil has a high content of organic matter. Runoff is slow or very slow.

Wetness is the main limitation to use of this soil. Drainage is required for good growth of row crops. Shallow surface drains are effective if outlets are available. Most of the acreage is used for permanent pasture or trees. Capability unit IIIw–6; woodland group 7; shrub and vine group C; wildlife group 5b.

Sebewa Series

The Sebewa series consists of poorly drained soils in depressions and drainageways on outwash plains. These soils are moderately deep to sand and gravel. They formed in a thin silt mantle and underlying stratified sand and gravel. Slopes are 0 to 2 percent.

In a representative profile the surface layer is very dark brown heavy silt loam about 12 inches thick. The subsoil extends to a depth of about 29 inches. It is dark-gray silty clay loam with yellowish-red mottles in the upper part, brown to dark-brown silty clay loam with yellowish-red and dark yellowish-brown mottles in the middle part, and brown to dark-brown clay loam with yellowish-red and grayish-brown mottles in the lower part. The substratum, to a depth of 60 inches, is yellowish-brown medium and coarse sand.

Sebewa soils have medium available water capacity. The subsoil is moderately permeable and the substratum is rapidly permeable. Reaction is mildly alkline.

Representative profile of Sebewa silt loam (0 to 2 percent slopes) in hay land (SW¼NW¼ sec 3, T. 23 N., R. 19 E., 300 feet east of farm pond):

A1—0 to 12 inches, very dark brown (10YR 2/2) heavy silt loam; moderate, medium, granular structure; very friable; common roots; mildly alkaline; clear, irregular boundary.

B21gt—12 to 19 inches, dark-gray (10YR 4/1) silty clay loam; common, medium, prominent, yellowish-red (5YR 4/6) mottles; moderate, medium, subangular blocky structure; sticky; common roots in upper 3 inches; mildly alkaline; clear, irregular boundary.

B22t—19 to 24 inches, brown to dark-brown (10YR 4/3) silty clay loam; many, coarse, prominent, yellowish-red (5YR 4/6) and common, medium, faint, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, angular blocky structure; sticky; thin medium clay films; mildly alkaline; clear, irregular boundary.

B3t—24 to 29 inches, brown to dark-brown (10YR 4/3) clay loam with reddish-brown (5YR 5/4) blotches; common, medium, faint, grayish-brown (2.5Y 5/2) and common, medium, prominent, yellowish-red (5YR 5/8) mottles; weak, coarse, subangular blocky structure; sticky; patchy clay films; mildly alkaline· clear, irregular boundary.

IIC—29 to 60 inches yellowish-brown (10YR 5/4) medium and coarse sand; single grain; nonsticky; calcareous; many lighter and darker colored grains.

The depth to carbonates and the thickness of the solum ranges from 20 to 40 inches but most commonly is 24 to 36 inches. The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). The B horizon is gravelly clay loam, clay loam, silty clay loam, or heavy loam that has hues of 10YR, 2.5Y, and 5Y. The C horizon is dominantly gravel, coarse sand, or stratified sand and gravel.

Sebewa soils are commonly associated with the well-drained Dresden soils, the somewhat poorly drained Dresden, mottled subsoil variant, soils, and the Fabius soils. Sebewa soils are wetter than these associated soils.

Sebewa silt loam (0 to 2 percent slopes) (Sb).—This soil is in depressions and waterways on outwash plains. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of somewhat poorly drained Dresden, mottled subsoil variant, soils. Also included were soils that have a thinner solum than that of this soil and soils that have a substratum of light loam or sandy loam.

Natural fertility in this soil is medium, and organic-matter content is high. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow.

Artificial drainage is needed in cultivated areas. Shallow ditches are suitable. If this soil is drained, it is suited to most crops commonly grown in the county. Capability unit IIw–5; woodland group 7; shrub and vine group C; wildlife group 5b.

Shawano Series

The Shawano series consists of deep, excessively drained soils on sandy lacustrine plains, outwash plains, and ridges. These soils formed under mixed hardwoods and conifers. Slopes range from 2 to 30 percent.

In a representative profile the surface layer is dark yellowish-brown loamy fine sand about 10 inches thick. In places gray to light-gray grains and very dark gray blotches are present in this layer. The subsoil extends to a depth of about 19 inches. It is brown to dark-brown fine and medium sand. The substratum, to a depth of 60 inches, is reddish-yellow medium sand.

Shawano soils have low available water capacity and rapid permeability. Reaction is slightly acid to neutral.

Representative profile of Shawano loamy fine sand, 2 to 6 percent slopes, in a wooded area (NE¼NW¼ sec. 29, T. 25 N., R. 20 E., 100 feet west of highway intersection):

Ap—0 to 10 inches, dark yellowish-brown (10YR 3/4) loamy fine sand; weak, medium, subangular blocky structure parting to single grain; loose; common roots; very dark gray (10YR 3/1) blotches and gray to light-gray (10YR 6/1) grains in places; slightly acid; abrupt, wavy boundary.

B—10 to 19 inches, brown to dark-brown (7.5YR 4/4) fine and medium sand; single grain; loose; slightly acid; gradual, irregular boundary.

C—19 to 60 inches, reddish-yellow (7.5YR 6/6) medium sand; single grain; loose; slightly acid.

The solum ranges from about 18 to 36 inches in thickness, and depth to free carbonates is 60 inches or more. The Ap horizon ranges from 7 to 12 inches in thickness. Undisturbed areas have an A1 horizon of dark-brown (10YR 2/2) loamy fine sand about 3 inches thick. In areas of blowouts 1 to 3 inches of sandy overburden covers the A1 horizon. An incipient A2 horizon also occurs in a few areas. The C horizon ranges from brown (7.5YR 5/4) to reddish yellow (7.5YR 6/6).

Shawano soils are near Tedrow and Roscommon soils. They are better drained than these soils.

Shawano fine sand, rolling (6 to 12 percent slopes) (SeC).—This soil is on dune ridges on glacial outwash plains. The surface layer is thinner, and it has a lighter color and higher sand content; but the profile otherwise is similar to that described as representative of the series. In places the surface layer is absent and scattered blowouts are present.

Included with this soil in mapping were small areas of gently sloping Shawano loamy fine sand.

Natural fertility and organic-matter content in this soil are very low. The effective depth to which roots can penetrate is 40 inches or more. The soil is susceptible to soil blowing.

Because fertility and available water capacity are low this soil is better suited to trees or wildlife habitat than to other uses. Capability unit VIs–3; woodland group 4; shrub and vine group B; wildlife group 3.

Shawano fine sand, hilly (12 to 30 percent slopes) (SeD).—This soil is on dune ridges on outwash plains. The surface layer is thinner and the subsoil is exposed in places, but the profile otherwise is similar to the one described as representative of the series. A few blowouts are throughout the area.

Included with this soil in mapping were small areas of Shawano fine sand, rolling, and areas of moderately steep Shawano loamy fine sand.

Natural fertility and organic-matter content in this soil are very low. The soil is very susceptible to soil blowing. The effective depth to which roots can penetrate is 40 inches or more.

Because of the very low fertility, the low available water capacity, and the hazard of erosion, this soil is better suited to trees and wildlife habitat than to crops. Much of the acreage is idle or is wooded. Capability unit VIIs–9; woodland group 4; shrub and vine group B; wildlife group 3.

Shawano loamy fine sand, 2 to 6 percent slopes (SfB).—This soil is on sandy lacustrine plains and on outwash plains. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of nearly level Shawano soils and small areas of moderately eroded Shawano soils.

Natural fertility and the content of organic matter in this soil are low. The effective depth to which roots can penetrate is 40 inches or more. The low fertility level and low available water capacity are the main limitations to use. This soil is subject to soil blowing. It is better suited to trees or to wildlife habitat than to cultivated crops. Capability unit IVs–3; woodland group 4; shrub and vine group B; wildlife group 3.

Shawano loamy fine sand, 6 to 12 percent (SfC).—This soil is on sandy lacustrine plains and outwash plains. The surface layer is thinner than that in the profile described as representative of the series.

Included with this soil in mapping were moderately eroded Shawano soils and a few small areas of moderately steep Shawano soils.

Natural fertility and content of organic matter in this soil are low. The effective depth to which roots can penetrate is 40 inches or more. Low natural fertility and low available water capacity are the main limitations to use. The soil is susceptible to soil blowing. It is better suited to trees and to wildlife habitat than to cultivated crops. Capability unit VIs-3; woodland group 4; shrub and vine group B; wildlife group 3.

Shullsburg Series, Wet Variant

The Shullsburg series, wet variant, consists of moderately deep, somewhat poorly drained soils. These soils formed in a thin silt mantle and underlying weathered shale. Slopes are 2 to 6 percent.

In a representative profile the surface layer is black silt loam about 8 inches thick. The subsoil extends to a depth of 23 inches. It is olive-gray silty clay with strong-brown mottles in the upper part and yellowish-brown mottles in the lower part. Below the subsoil is olive-gray weathered shale.

Shullsburg soils have low available water capacity and slow permeability. Reaction is neutral to mildly alkaline.

Representative profile of Shullsburg silt loam, wet variant, 2 to 6 percent slopes, in an area of idle land (NW¼SW¼SE¼, sec. 1, T. 24 N., R. 21 E., 30 feet north of the road):

A1—0 to 8 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; many roots; moderately alkaline; clear, smooth boundary.

IIB21t—8 to 18 inches, olive-gray (5Y 5/2) silty clay; common, medium, prominent, strong-brown (7.5YR 5/6) mottles; moderate, coarse, subangular blocky structure; firm when moist, very hard when dry; many roots; thin patchy clay films; calcareous; clear, smooth boundary.

IIB22t—18 to 23 inches, olive-gray (5Y 5/2) silty clay; common, coarse, prominent, yellowish-brown (10YR 5/8) mottles; strong, coarse, subangular blocky structure; firm when moist, very hard when dry; few roots; medium continuous clay films; calcareous; abrupt, smooth boundary.

IIR—23 to 60 inches, olive-gray (5Y 5/2) shale.

The silt mantle ranges from 6 to 10 inches in thickness. The solum is commonly 20 to 24 inches thick but ranges from 20 to 30 inches. The A horizon ranges from black (10YR 2/1) to very dark grayish-brown (10YR 3/2). In the B horizon hues are 2.5Y and 5Y, values are 4 to 6, and chromas are 2 to 4.

Shullsburg, wet variant, soils are near Manawa soils and Stony and rocky land. Unlike the Manawa soils, they are underlain by distinctive olive-gray weathered shale rather than reddish-brown clay loam glacial till.

Shullsburg silt loam, wet variant, 2 to 6 percent slopes (SgB).—This soil is in long, narrow areas on gentle slopes.

Included with this soil in mapping were some small areas of Kewaunee and Manawa soils.

Natural fertility in this soil is medium, and organic-matter content is high. Runoff is slow. Wetness is the main limitation to use.

If surface drains are provided, this soil is suited to most crops commonly grown in the county. Most of the acreage is used for permanent pasture. Capability unit IIw-5; woodland group 7; shrub and vine group A; wildlife group 5a.

Sisson Series

The Sisson series consists of deep, well-drained soils on glacial lake plains. These soils formed in a loamy mantle and the underlying stratified silt and very fine sand. Slopes are 1 to 20 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsurface layer is pinkish-gray silt loam about 2 inches thick. The subsoil extends to a depth of 25 inches and is reddish-brown silt loam in the upper part, reddish-brown silty clay loam in the middle part, and reddish-brown silt loam in the lower part. The substratum, to a depth of 60 inches, is light-brown and light yellowish-brown stratified silt and very fine sand.

Sisson soils have medium available water capacity. Permeability is moderate. Reaction is neutral to mildly alkaline.

Representative profile of Sisson silt loam, 2 to 6 percent slopes, in a cultivated area (NE¼NW¼NW¼, sec. 10, T. 24 N., R. 22 E., south of County Highway K, across from woodlot):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable; common roots; neutral; abrupt, wavy boundary

A2—6 to 8 inches, pinkish-gray (7.5YR 6/2) silt loam; weak, medium, platy structure; very friable; common roots; neutral; abrupt, irregular boundary.

B1—8 to 11 inches, reddish-brown (5YR 4/4) silt loam; moderate, medium, subangular blocky structure; firm; pinkish-gray (7.5YR 6/2) fingers of material from the A2 horizon are present in less than 10 percent of horizon; neutral; abrupt, irregular boundary.

B2t—11 to 22 inches, reddish-brown (5YR 5/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; moderately thick patchy clay films; mildly alkaline; clear, irregular boundary.

B3—22 to 25 inches, reddish-brown (5YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; mildly alkaline, clear, irregular boundary.

C—25 to 60 inches, light-brown (7.5YR 6/4) and light yellowish-brown (10YR 6/4) stratified silt and very fine sand; moderate, medium, platy structure; friable; calcareous.

The solum ranges from 24 to 40 inches in thickness Where the soil is uncultivated, the A1 horizon is very dark grayish-brown silt loam 1 to 3 inches thick. The texture of the A horizon is silt loam or fine sandy loam. The B horizon has a hue of 10YR, 7.5YR, or 5YR; a value of 4 to 5; and a chroma of 4. The C horizon commonly is stratified silt and very fine sand; but in some places it contains lenses of fine sand, silty clay loam, or both.

Sisson soils are near Boyer and Hochheim soils They are finer textured than Boyer soils, and they lack the subsoil and substratum developed from glacial till that is characteristic of the Hochheim soils.

Sisson fine sandy loam, 2 to 6 percent slopes (ShB).—This soil is on glacial lake plains. The surface layer is more sandy, but the profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping were nearly level and gently sloping lacustrine soils that are similar to Sisson soils except that the silty clay loam part of the subsoil is thin or missing. Also included were small areas of eroded Sisson fine sandy loam.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to

which roots can penetrate is 40 inches or more. Runoff is slow. Erosion is the main hazard.

If this soil is farmed intensively, erosion-control measures are beneficial in preventing soil loss. This soil is suited to the crops commonly grown in the county. Capability unit IIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Sisson fine sandy loam, 6 to 12 percent slopes, eroded (ShC2).—This soil has convex slopes on narrow to moderately broad ridgetops in glacial lake plains. The surface layer has a higher sand content and is thinner than that in the profile described as representative of the series, and the subsoil is thinner. Generally some of the reddish-brown material from the subsoil has been mixed into the surface layer by tillage.

Included with this soil in mapping were areas of sloping Sisson fine sandy loams that are only slightly eroded. Also included were spots where the soil is severely eroded and areas of sloping soils that have a coarser textured subsoil.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. Erosion is the main limitation to use.

Erosion control helps to reduce the amount of soil loss where the soil is farmed intensively. This soil is suited to all crops commonly grown in the county. Capability unit IIIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Sisson fine sandy loam, 12 to 20 percent slopes, eroded (ShD2).—This soil has convex slopes and is on narrow ridgetops in glacial lake plains. The surface layer has a greater sand content and is thinner than the one in the profile described as representative of the series. The subsoil also is thinner. In cultivated areas some of the material from the subsoil has been mixed into the surface layer.

Included with this soil in mapping were several areas of moderately steep and steep soils in which the silty clay loam subsoil is thin or absent.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. Cultivated areas are very susceptible to erosion.

Erosion-control measures, such as stripcropping, help to reduce the amount of soil loss when the soil is planted to row crops. This soil is fairly well suited to the crops commonly grown in the county. Capability unit IVe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Sisson silt loam, 0 to 2 percent slopes (SnA).—This soil is on glacial lake plains. It has a thicker surface layer and slightly thicker subsoil than that in the profile described as representative of the series (fig. 12).

Included with this soil in mapping were a few areas of nearly level soils in which the silty clay loam part of the subsoil is thinner than that of Sisson soils or is absent.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Limitations to use of this soil for crops are very slight.

This soil is well suited to all crops commonly grown in the county. Capability unit I–1; woodland group 1; shrub and vine group A; wildlife group 1.

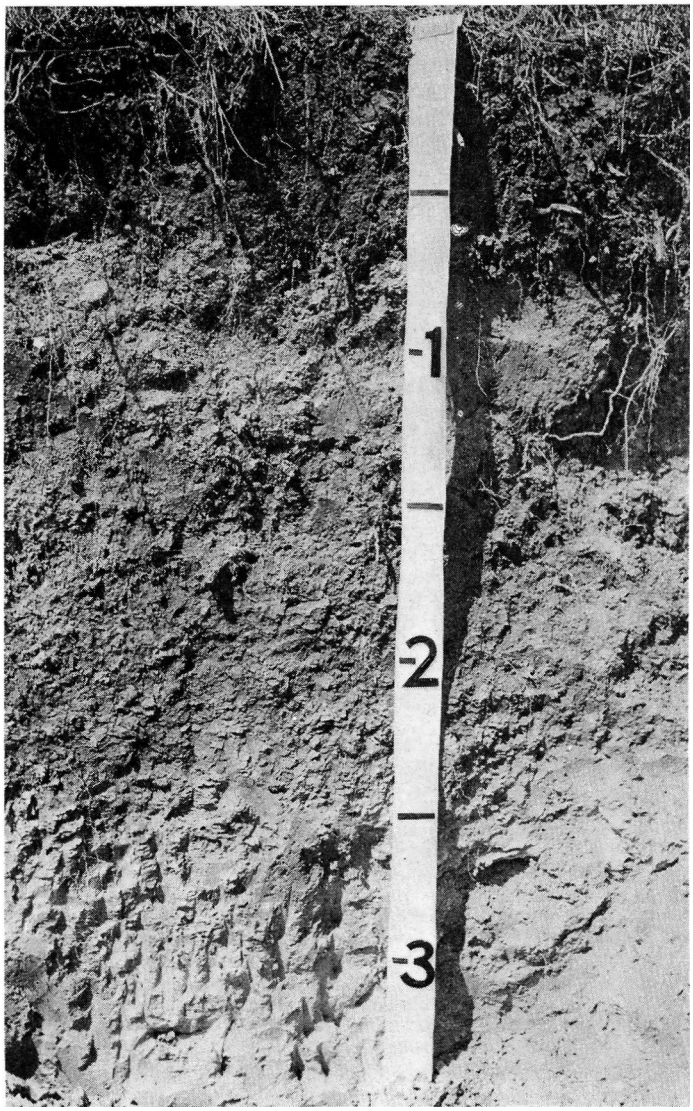

Figure 12.—Typical profile of a Sisson silt loam.

Sisson silt loam, 2 to 6 percent slopes (SnB).—This soil is on glacial lake plains. It has the profile described as representative of the series.

Included with this soil in mapping were a few areas of eroded Sisson soil and a few areas of soils in which the silty clay loam part of the subsoil is thin or absent. Some of these included soils are moderately eroded.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Erosion is the main hazard on this soil, and erosion-control measures are helpful where the soil is farmed intensively.

This soil is well suited to all crops commonly grown in the county. Capability unit IIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Solona Series

The Solona series consists of deep, somewhat poorly drained soils in depressions and drainageways on glacial till plains. They formed in loamy glacial till. Slopes are 1 to 3 percent.

In a representative profile the surface layer is very dark brown loam about 9 inches thick. The subsurface layer, about 6 inches thick, is grayish-brown to brown sandy loam. It has strong-brown mottles. The subsoil extends to a depth of about 26 inches. The upper 2 inches is brown light loam that has light brownish-gray and strong-brown mottles. The lower part, about 9 inches thick, is reddish-brown clay loam that has strong-brown and light brownish-gray mottles. The substratum, to a depth of 60 inches, is reddish-brown loam. Mottles are yellowish red and light brownish gray.

Solona soils have high available water capacity and moderate permeability. Reaction is mildly alkaline to moderately alkaline.

Representative profile of Solona loam, 1 to 3 percent slopes (SW¼SW¼ sec. 4, T. 25 N., R. 19 E., 825 feet east of SW section corner and 40 feet north of County Highway B):

Ap—0 to 9 inches, very dark brown (10YR 2/2) loam; weak, medium and coarse, subangular blocky structure; friable; common roots; moderately alkaline; clear, irregular boundary.

A2—9 to 15 inches, grayish-brown (10YR 5/2) to brown (10YR 5/3) sandy loam; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; friable; brownish-yellow (10YR 6/6) weathered fragments of limestone; mildly alkaline; clear, wavy boundary

B1—15 to 17 inches, brown (7.5YR 5/4) light loam; common, coarse, prominent, strong-brown (7.5YR 5/8) and few, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable, brownish-yellow (10YR 6/6) weathered fragments of limestone; mildly alkaline; abrupt, wavy boundary

B2t—17 to 26 inches, reddish-brown (5YR 5/4) clay loam; common, coarse, prominent, strong-brown (7.5YR 5/8) and few, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; firm, mildly alkaline; thin patchy clay films; gradual, irregular boundary

C—26 to 60 inches, reddish-brown (5YR 5/4) loam; common, medium, prominent, yellowish-red (5YR 5/8) and few, medium, distinct, light brownish-gray (10YR 6/2) mottles; massive; friable, calcareous.

The A horizon ranges in texture from loam to sandy loam. A thin layer of lacustrine silt or very fine sand occurs in the upper part of the B horizon in some areas. The thickness of the solum varies from 20 to 36 inches. Limestone cobblestones are present throughout the solum, and in places many are in the C horizon.

Solona soils are near Onaway, Angelica, and Menominee soils. They are the somewhat poorly drained member of the drainage sequence that includes the well-drained Onaway soils and the poorly drained Angelica soils. They have a finer texture and poorer drainage than the Menominee soils.

Solona sandy loam, 1 to 3 percent slopes (SoA).—This soil is in depressions and drainageways on glacial till plains. The surface layer is sandier than that in the profile described as representative of the series.

Included with this soil in mapping were small areas of well-drained Onaway soils, areas of poorly drained Angelica soils, and small areas of Allendale soils.

Natural fertility and the organic-matter content in this soil are medium. Runoff is slow. The effective depth to which roots can penetrate is 40 inches or more. Wetness is the main limitation to use. Tile drains or other drainage measures are helpful in removing excess water.

This soil is suited to most of the cultivated crops and the pasture and hay plants commonly grown in the county. Capability unit IIw–2; woodland group 7; shrub and vine group C; wildlife group 5a.

Solona loam, 1 to 3 percent slopes (SpA).—This soil is in depressions and drainageways on glacial till plains. It has the profile described as representative of the series.

Included with this soil in mapping were some small areas of well-drained Onaway soils and some poorly drained Angelica soils. Areas of Solona soils that have a silt loam surface layer were also included.

Natural fertility and the content of organic matter in this soil are medium. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow. Wetness is the main hazard of this soil. The use of field tile or other drainage systems helps to remove excess water where row crops are grown. If drained, this soil is suited to most cultivated crops and pasture and hay plants commonly grown in the county. Capability unit IIw–2; woodland group 7; shrub and vine group C; wildlife group 5a.

Stony and Rocky Land

Stony and rocky land (Sr) is gently sloping to very steep land on which rock outcrops and stones dominate the surface area. It is made up mostly of areas of exposed limestone bedrock near vertical escarpments and talus slopes strewn with dolomitic stones and boulders that are 6 feet or more in diameter. In Brown County the best example of stony and rocky land is the Niagara escarpment, locally known as "the ledge." This formation extends from the northeastern corner of the county to the southwestern corner, near Askeaton.

Runoff is very rapid, and the erosion hazard is severe. In areas where soil material is present, the natural fertility and available water capacity are low.

Stony and rocky land is poorly suited to farming, but some of the more gently sloping land is used for grazing or is wooded. The land is suited to wildlife habitat. It is a source of building stone and is valuable for its scenic beauty. Capability unit VIIIs–10; woodland group 11; shrub and vine group D; wildlife group 8.

Summerville Series

The Summerville series consists of shallow, well-drained soils on till plains. The underlying limestone bedrock has a strong influence on topography. Slopes are 1 to 20 percent.

In a representative profile the surface layer is very dark grayish-brown loam about 7 inches thick. The subsoil extends to a depth of 14 inches and is brown to dark-brown loam. Limestone bedrock is immediately below the subsoil.

Summerville soils have very low available water capacity and moderate permeability. Reaction is mildly alkaline.

Representative profile of Summerville loam, 1 to 6 percent slopes, in a cultivated area (NE¼NE¼ sec. 27, T.

25 N., R. 22 E., 415 yards south and 120 feet west of northeast section corner):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) loam; moderate, medium and fine, granular structure; very friable; common roots; mildly alkaline; abrupt, smooth boundary.

B2ir—7 to 14 inches, brown to dark-brown (7.5YR 4/4) loam; moderate, coarse to fine, subangular blocky structure; friable; common roots in upper 5 inches; mildly alkaline; abrupt, smooth boundary.

IIR—14 to 60 inches; limestone bedrock.

The thickness of the solum and the depth to bedrock range from 10 to 20 inches. In places these soils have an A1 horizon of very dark brown (10YR 2/2) silt loam over an AB horizon of very dark gray (10YR 3/1) and reddish-brown (5YR 4/4) silt loam or loam that contains some fine glacial pebbles. The B horizon has hues of 5YR or 7.5YR, values of 4 or 5, and chromas of 3 or 4. Texture is light clay loam or loam. Pebbles, sand particles, and fragments of limestone are in the lower part of the B horizon in places

Summerville soils are near the Summerville, clayey subsoil variant, and the Hochheim and Namur soils. They have a coarser textured subsoil than the Summerville, clayey subsoil variant, soils and are not so deep as Hochheim soils. Summerville soils are deeper to bedrock than the very shallow Namur soils.

Summerville loam, 1 to 6 percent slopes (SuB).—This soil is on glacial till plains. It has the profile described as representative of the series. Undisturbed areas have a very dark brown surface layer. Included in mapping were small areas of eroded Summerville soils.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 20 inches or less. Runoff is medium. Erosion is the main hazard on this soil, but another concern is the very low available water capacity and its effect on the growth of crops.

Erosion control and moisture-conserving practices are beneficial when the soil is cropped intensively. The soil is suited to most crops commonly grown in the county. Capability unit IIIe–3; woodland group 5; shrub and vine group B; wildlife group 8.

Summerville loam, 6 to 20 percent slopes, eroded (SuD2).—This soil is on hillsides on glacial till plains. The surface layer is thinner and lighter colored than the one in the profile described as representative of the series.

Included with this soil in mapping were some small areas of soils that have a finer textured subsoil than this soil. In places these included soils that are only slightly eroded. A few small areas of gently sloping Summerville soils were also included.

Natural fertility and organic-matter content in this soil are low. The effective depth for root growth is shallow, and runoff is medium. Further erosion is a severe hazard, but very low available water capacity is also a limitation for crops.

Erosion control and moisture-conserving practices are beneficial if the soil is cultivated. The soil has a fair potential for all crops commonly grown in the county. Capability unit IVe–3; woodland group 5; shrub and vine group B; wildlife group 8.

Summerville Series, Clayey Subsoil Variant

These variants from the normal Summerville soils are shallow, well-drained soils on glacial till plains. Slopes are 1 to 6 percent. The underlying limestone bedrock has a strong influence on topography.

In a representative profile the surface layer is brown to dark-brown silt loam about 8 inches thick. The subsoil extends to a depth of about 18 inches. It is brown to dark-brown loam in the upper part, dark reddish-brown heavy clay loam in the middle part, and reddish-brown loam in the lower part. Limestone bedrock is directly below the subsoil.

These soils have low available water capacity and moderately slow permeability. Reaction is mildly alkaline.

Representative profile of Summerville silt loam, clayey subsoil variant, 1 to 6 percent slopes, in a cultivated area (SW¼NW¼ sec. 8, T. 24 N., R. 22 E., fresh road cut 75 feet east of field entrance):

Ap—0 to 8 inches, brown to dark-brown (7.5YR 4/2) silt loam, moderate, medium, granular structure, very friable; mildly alkaline; abrupt, wavy boundary.

Bir—8 to 11 inches, brown to dark-brown (7.5YR 4/4) loam; weak, medium, subangular blocky structure parting to weak, fine, granular; friable; some brown (10YR 5/3) blotches in the upper inch; mildly alkaline; clear, irregular boundary.

A'&B'—11 to 13 inches, brown (10YR 5/3) loam; weak, medium, subangular blocky structure parting to weak, fine, subangular blocky; firm; mildly alkaline; abrupt, irregular boundary.

B'2t—13 to 16 inches, dark reddish-brown (5YR 3/4) heavy clay loam; weak, coarse, subangular blocky structure parting to moderate, medium, subangular blocky; firm; thin continuous clay films; mildly alkaline; clear, wavy boundary.

B'3—16 to 18 inches, reddish-brown (5YR 4/4) loam; weak, medium, subangular blocky structure; friable; brown (7.5YR 5/4) weathered fragments; moderately alkaline; abrupt, wavy boundary.

IIR—18 to 60 inches, limestone bedrock.

The solum is commonly 14 to 20 inches thick but ranges from 10 to 24 inches. Thickness of the solum generally is the same as depth to the limestone bedrock. The Bt horizon ranges from clay loam to silty clay. The B3 horizon is absent in some areas, mostly where the depth to bedrock is less than 14 inches.

Summerville, clayey subsoil variant, soils are near the Summerville, Ruse, and Kolberg soils. They have finer textures in the B horizon than Summerville soils, are not so deep to bedrock as the Kolberg soils, and are better drained than Ruse soils.

Summerville silt loam, clayey subsoil variant, 1 to 6 percent slopes (SvB).—This soil is on glacial till plains. It is the only variant of the normal Summerville series mapped in the county.

Included with this soil in mapping were areas of Kolberg and Summerville soils and small areas of Namur soils.

Natural fertility in this soil is medium, and organic-matter content is low. The effective rooting zone is shallow. Runoff is medium. Erosion and drought are the main limitations to use of this soil.

Erosion control helps to reduce the amount of soil loss. This soil is suited to most of the crops commonly grown in the area. Capability unit IIIe–3; woodland group 5; shrub and vine group B; wildlife group 8.

Tedrow Series

The Tedrow series consists of deep, somewhat poorly drained soils on sandy lacustrine and outwash plains. These soils formed in deep sands. Slopes are 0 to 3 percent.

In a representative profile the surface layer is dark-brown loamy fine sand about 3 inches thick. The subsur-

face layer is about 4 inches thick. It is grayish-brown loamy fine sand with strong-brown mottles. The subsoil extends to a depth of about 22 inches; and it is mixed brown, light brownish-gray, and yellowish-red fine sand. The substratum, to a depth of 60 inches, is yellowish-brown fine sand mottled with strong brown.

Tedrow soils have low available water capacity and rapid permeability. Reaction is neutral.

Representative profile of Tedrow loamy fine sand, 0 to 3 percent slopes, in a wooded area (NE¼NW¼ sec. 11, T. 25 N., R. 20 E., 300 feet south of road, 20 feet west into woods):

A1—0 to 3 inches, dark-brown (7.5YR 3/2) loamy fine sand, moderate, medium, crumb structure; very friable; common roots; many white (10YR 8/1) sand grains; slightly acid; clear, wavy boundary

A2—3 to 7 inches, grayish-brown (10YR 5/2) loamy fine sand; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium, crumb structure; very friable; many roots; black fragments of charcoal; some dark-brown (7.5YR 3/3) A1 horizon peds, neutral; clear, wavy boundary.

B2—7 to 22 inches, reticulate, brown (7.5YR 5/4), light brownish-gray (10YR 6/2), and yellowish-red (5YR 4/6) fine sand; single grain; loose; few roots; 5 to 10 percent dark-colored sand grains; neutral; clear, wavy boundary

C—22 to 60 inches, yellowish-brown (10YR 5/4) fine sand; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; single grain; loose; neutral.

The Ap horizon ranges from 6 to 8 inches in thickness In undisturbed areas, thickness of the A1 horizon ranges from 3 to 5 inches. The Ap or A1 horizon has a hue of 10YR, a value of 2 or 3, and a chroma of 1 or 2 Texture is dominantly loamy fine sand but in places ranges to fine sandy loam The C horizon is brown (10YR 5/), grayish brown (10YR 5/2), or yellowish brown (10YR 5/4). It is dominantly fine sand but ranges to medium sand Thin silt layers are present below a depth of 40 inches in a few places.

Tedrow soils are near Shawano, Roscommon, and Yahara soils. They form a drainage sequence with the well-drained to excessively drained Shawano soils and the poorly drained Roscommon soils. They lack the stratified silt and very fine sand substratum of Yahara soils

Tedrow loamy fine sand, 0 to 3 percent slopes (TeA).—This soil is on lacustrine or outwash plains.

Included with this soil in mapping were small areas of gently sloping Tedrow soils and a few small areas of well-drained Shawano soils and poorly drained Roscommon soils. Some areas of Tedrow soils that have a surface layer of fine sandy loam were also included.

Natural fertility and organic-matter content in this soil are low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow, and wetness is the main hazard to crops.

Surface drains help to remove excess water for better crop growth. The soil is fairly well suited to most crops commonly grown in the county. Capability unit IVw–5; woodland group 8; shrub and vine group C; wildlife group 5a.

Wauseon Series

The Wauseon series consists of deep, poorly drained soils in depressions on glacial till or lacustrine plains. These soils formed in sandy deposits 18 to 40 inches thick and the underlying calcareous clayey material. Slopes are 0 to 2 percent.

In a representative profile the surface layer is black fine sandy loam about 11 inches thick. The subsoil extends to a depth of about 30 inches. The upper part is dark-gray sandy loam with dark yellowish-brown mottles, and the middle part is brown to dark-brown loamy sand with yellowish-brown mottles. The lower part is reddish-brown heavy clay loam with yellowish-red mottles. The substratum, to a depth of 60 inches, is reddish-brown silty clay loam.

Wauseon soils have medium available water capacity. Permeability is moderately rapid in the sandy material and slow in the clayey material. Reaction is slightly acid to neutral.

Representative profile of Wauseon fine sandy loam in an area of idle land (NW¼NW¼ sec. 32, T. 23 N., R. 21 E., 350 yards north of County Highway G and 50 feet east of fence line):

A1—0 to 11 inches, black (10YR 2/1) fine sandy loam; moderate, medium, granular structure; very friable; common roots; neutral; clear, wavy boundary.

B1g—11 to 13 inches, dark-gray (10YR 4/1) sandy loam; few, fine, prominent, dark yellowish-brown (10YR 4/4) mottles; weak, medium to coarse, subangular blocky structure; nonsticky when wet; neutral; abrupt, wavy boundary.

B21—13 to 24 inches, brown to dark-brown (10YR 4/3) loamy sand; common, medium, distinct, yellowish-brown (10YR 5/6) mottles, weak, medium, granular structure: nonsticky when wet; neutral; clear, irregular boundary.

IIB22—24 to 30 inches, reddish-brown (5YR 5/3) heavy clay loam; many, fine, prominent, yellowish-red (5YR 5/8) mottles; moderate, medium, subangular blocky structure; sticky when wet; neutral; clear, irregular boundary.

IIC—30 to 60 inches, reddish-brown (5YR 5/3) silty clay loam; massive; sticky when wet; calcareous.

The sandy material in the upper part of the solum ranges from 18 to 40 inches in thickness. In some places an organic layer up to 12 inches thick is on the surface The C horizon is clayey lacustrine sediment or glacial till.

Hues in the lower part of the B horizon and in the C horizon are redder than is typical for the Wauseon series

Wauseon soils are near Allendale and Manistee soils. They are the poorly drained soils of a drainage sequence that includes the well-drained Manistee and the somewhat poorly drained Allendale soils.

Wauseon fine sandy loam (0 to 2 percent slopes) (Wa).—This is the only Wauseon soil mapped in the county. It is in depressions on glacial till or lacustrine plains.

Included with this soil in mapping were small areas of a Wauseon soil that has a loam surface layer. A few gently sloping Wauseon soils were also included.

Natural fertility in this soil is low, and organic-matter content is medium. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow, and wetness is the main hazard to crops.

Drainage helps to remove excess water when this soil is used for crops. If drained, the soil is suited to most of the crops commonly grown in the county. Capability unit IIIw–6; woodland group 7; shrub and vine group C; wildlife group 5b.

Waymor Series

The Waymor series consists of deep, well-drained soils on glacial till plains and ridges. These soils formed in a loamy or silty mantle and the underlying calcareous, loamy glacial till. Slopes are 0 to 20 percent.

In a representative profile the surface layer is very dark grayish-brown silt loam about 9 inches thick. The subsurface layer is brown to pale-brown silt loam about 4 inches thick. The subsoil extends to a depth of about 34 inches. It is brown to dark-brown silt loam in the upper part, reddish-brown silty clay loam in the middle part, and reddish-brown clay loam in the lower part. The substratum, to a depth of 60 inches, is brown loam that contains many fragments of limestone.

Waymor soils have high available water capacity and moderate permeability. Reaction is neutral to moderately alkaline.

Representative profile of Waymor silt loam, 2 to 6 percent slopes, in a cultivated area (SW¼SW¼, sec. 8, T. 21 N., R. 21 E., on north side of the road, 275 yards east of southwest section corner):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, subangular blocky structure, friable; many roots; mildly alkaline; abrupt, smooth boundary.

A2—9 to 13 inches, brown to pale-brown (10YR 5/3 and 6/3) silt loam; weak, fine, platy structure; very friable; common roots; mildly alkaline; abrupt, smooth boundary.

B1—13 to 16 inches, brown to dark-brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; common roots; few bleached ped coatings; mildly alkaline; clear, wavy boundary

B21t—16 to 26 inches, reddish-brown (5YR 4/3) heavy silty clay loam; moderate, medium, angular blocky structure; firm; continuous clay films on ped faces; mildly alkaline; clear, irregular boundary

IIB22t—26 to 34 inches, reddish-brown (5YR 4/3) clay loam; moderate, medium, angular blocky structure; firm; continuous clay films on ped faces; calcareous; gradual, irregular boundary.

IIC—34 to 60 inches brown (7.5YR 5/4) loam; massive in place parting to very weak, medium, subangular blocky structure; friable; many coarse fragments of limestone; mildly calcareous.

The solum ranges from 20 to 40 inches in thickness, but it generally is 28 to 35 inches. In uncultivated areas the A1 has colors in hues of 10YR or 7.5YR, values of 2 to 4, and chromas of 0 to 2. The A2 horizon has colors in hues of 10YR or 7.5YR, values of 5 or 6, and chromas of 2 or 3 The texture of the A horizon is sandy loam or silt loam The B horizon has colors in hues of 7.5YR or 5YR; values of 4, 5, or 6; and chromas of 3, 4, or 6. The C horizon has colors in hues of 7.5YR or 5YR; values of 4 or 5; and chromas of 4, 6, or 8 Coarse fragments of limestone make up from 10 to 30 percent of the C horizon The texture generally is loam but ranges to silt loam or heavy sandy loam.

The sandy loam of the A horizon has a higher percentage of sand than is typical of the series

The Waymor soils are near Lamartine soils They are better drained than the Lamartine soils

Waymor sandy loam, 2 to 6 percent slopes (WmB).—This soil is on glacial till plains. The sand content of the surface layer is higher, and the surface layer and subsoil are thinner than those in the profile described as representative of the series. In places material from the surface and subsurface layers has become mixed by tillage.

Included with this soil in mapping were soils that are similar to Waymor soils but have a heavier textured substratum and have moderately slow permeability. Small areas of soils that have a loam surface layer were also included.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more. Runoff is medium. Erosion is the major hazard.

Erosion-control practices are beneficial where row crops are grown. This soil is suited to all crops commonly grown in the county. Capability unit IIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Waymor silt loam, 0 to 2 percent slopes (WoA).—This soil is on glacial till plains. It has a darker surface layer and a thicker surface layer and subsoil than those in the profile described as representative of the series. Most of the soil is in cultivation, and material from the subsurface layer has become mixed with the material in the surface layer.

Included with this soil in mapping were a few areas of soils similar to Waymor silt loam that have a heavier textured substratum and have moderately slow permeability. Small areas of soils that have a heavier textured subsoil or that have a loam surface layer were also included.

Natural fertility in this soil is medium, and the content of organic matter is low. The effective depth to which roots can penetrate is 40 inches or more.

This soil has few limitations for cultivation and is well suited to all crops grown in the county. Capability unit I–1; woodland group 1; shrub and vine group A; wildlife group 1.

Waymor silt loam, 2 to 6 percent slopes (WoB).—This soil is on glacial till plains. It has the profile described as representative of the Waymor series.

Included with this soil in mapping were a few areas of soils that are similar to Waymor silt loam but have a heavier textured subsoil. Also included were a few areas of soils that have a heavier textured substratum and have moderately slow permeability. In addition, areas of eroded Waymor soils and some areas of soils that have a loam surface layer were included.

Natural fertility in this soil is medium, and the organic-matter content is low. Runoff is medium. Erosion is the major hazard.

Stripcropping and other control practices help to curb erosion where systems of intensive cropping are used. This soil is suited to all crops commonly grown in the county. Capability unit IIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Waymor silt loam, 6 to 12 percent slopes, eroded (WoC2).—This soil is on glacial till plains. It has a thinner and lighter colored surface layer than that in the profile described as representative of the series. In cultivated areas mixing of surface, subsurface, and subsoil material is common.

Included with this soil in mapping were areas of slightly eroded Waymor soils. Also included were areas of soils that have a surface layer of loam or sandy loam and areas of soils that are similar to Waymor soils but have a heavier textured substratum and have moderately slow permeability. In addition soils similar to Waymor soils except that they have a heavier textured subsoil were included.

Natural fertility in this soil is medium, and organic-matter content is low. Runoff is medium to rapid. Further erosion is a serious hazard.

Erosion-control practices and the use of green manure help to maintain good tilth and reduce erosion.

This soil is suited to the crops commonly grown in the county. Capability unit IIIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Waymor silt loam, 12 to 20 percent slopes, eroded (WoD2).—This soil is on ridges on glacial till plains. It has a thinner and lighter colored surface layer than that in the profile described as representative of the series, and the subsoil generally is thinner. The upper part of the subsoil has been mixed with the surface layer by tillage.

Included with this soil in mapping were small areas of Waymor soils that have a loam surface layer. Some areas of soils that have a heavier textured substratum than Waymor soils and have moderately slow permeability were also included. In addition a few small areas of only slightly eroded Waymor soils and a few areas of severely eroded Waymor soils were included.

Natural fertility in this soil is medium, and organic-matter content is low. Runoff is medium to rapid. Erosion is the main hazard.

Stripcropping and other soil conservation practices are beneficial where the soil is planted to row crops. The use of barnyard manure or green manure crops helps to maintain good tilth. This soil is suited to most of the pasture and hay crops commonly grown in the county. Capability unit IVe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Waymor-Casco-Sisson complex, 3 to 12 percent slopes (WsC).—These soils are in glacial morainic areas. The texture of the surface layer ranges from silt loam to very fine sandy loam. About 35 percent of the complex is Waymor soils; about 30 percent is Casco soils; about 20 percent is Sisson soils; and the remaining 15 percent is made up of Dresden, Sebewa, Kibbie, Lamartine, and Kewaunee soils.

The Waymor, Casco, and Sisson soils have profiles similar to those described as representative of their respective series.

In places in cultivated areas, small spots of eroded and severely eroded soils were included in mapping.

Most of the acreage is cultivated. Runoff is medium, and erosion is the main hazard.

Erosion-control practices help to reduce soil loss when this soil is planted to row crops. These soils are well suited to all farm crops commonly grown in the county. Capability unit IIe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Waymor-Casco-Sisson complex, 12 to 25 percent slopes (WsE).—These soils are on glacial morainic topography. The surface layer ranges from silt loam to very fine sandy loam. About 40 percent of the complex is Waymor soils; about 35 percent is Casco soils; about 20 percent is Sisson soils; and the remaining 5 percent is made up of Dresden, Kewaunee, Lamartine, Sebewa, and Kibbie soils.

The Waymor, Casco, and Sisson soils have profiles similar to those described as representative of their respective series; but the surface layer and subsoil generally are thinner.

Included with these soils in mapping were spots of moderately eroded and severely eroded soils.

Runoff is medium to rapid, and erosion is the main hazard. Most of the acreage is in pasture or in wooded areas that are used for grazing. The soils are better suited to pasture, trees, or wildlife than to crops. Capability unit IVe–1; woodland group 1; shrub and vine group A; wildlife group 1.

Yahara Series

The Yahara series consists of deep, somewhat poorly drained soils on glacial lake plains. Slopes are 0 to 3 percent.

In a representative profile the surface layer is very dark brown silt loam about 7 inches thick. The subsoil extends to a depth of 15 inches. The upper part is dark-brown fine sandy loam mottled with strong brown and gray. The lower part is brown to dark-brown fine sandy loam containing strong-brown and gray mottles. The substratum is brown stratified very fine sand and silt mottled with strong brown and gray.

Yahara soils have medium available water capacity and moderate permeability. Reaction is mildly alkaline.

Representative profile of Yahara silt loam, 0 to 3 percent slopes, in a pasture (SE¼SW¼ sec. 6, T. 24 N., R. 20 E., 3,300 feet west of southeast section corner and 30 feet north of road):

A1—0 to 7 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; very friable; common roots; mildly alkaline; abrupt, irregular boundary.

B21—7 to 11 inches, dark-brown (7.5YR 3/2) fine sandy loam; many, medium, prominent, strong-brown (7.5YR 5/6) mottles and common, fine, distinct, gray (10YR 5/1) mottles; weak, fine, subangular blocky structure parting to weak, medium, granular; friable; common roots; mildly alkaline, clear, irregular boundary.

B22—11 to 15 inches, dark-brown to brown (7.5YR 4/4) fine sandy loam; many, medium, faint, strong-brown (7.5YR 5/6) and few, fine, prominent, gray (10YR 5/1) mottles; weak, fine, granular structure; friable; common roots in upper inch; calcareous; clear, wavy boundary.

C—15 to 60 inches, brown (7.5YR 5/4) stratified very fine sand and silt; many, coarse, prominent, strong-brown (7.5YR 5/8) and few, fine, prominent, gray (10YR 5/1) mottles; nonsticky when wet; medium sands at a depth of 56 inches; calcareous

Reaction in the solum ranges from mildly alkaline to calcareous. Free carbonates generally occur within a depth of 2 feet. The A1 or Ap horizon ranges from very dark grayish brown (10YR 3/2) to black (10YR 2/1) in color and from fine sandy loam to silt loam in texture. In places material from the A and B horizons has been mixed by earthworm activity. A few pebbles about 10 millimeters in diameter are in the B horizon in places. The C horizon is mainly stratified coarse silt and very fine sand; but layers of medium sand, silty clay loam, or silty clay are present in places.

Yahara soils are near Kibbie, Tedrow, Pella, and Keowns soils. They are more alkaline in the solum and have coarser textures in the B horizon than Kibbie soils, and they are not so wet as the poorly drained Pella and Keowns soils or so sandy as the Tedrow soils.

Yahara fine sandy loam, 0 to 3 percent slopes (YaA).—This soil is on lacustrine plains. The surface layer has a higher sand content, but the profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping were small areas of gently sloping Yahara fine sandy loam and areas of Yahara silt loam.

Natural fertility and organic-matter content in this soil are medium. The effective depth to which roots can

penetrate is 40 inches or more. Runoff is slow. Wetness is the main limitation to use.

If surface drains are used to remove excess water, this soil is suited to most crops commonly grown in the county. Most undrained areas are in permanent pasture. Capability unit IIw–2; woodland group 7; shrub and vine group C; wildlife group 5a.

Yahara silt loam, 0 to 3 percent slopes (YhA).—This soil is on lacustrine plains. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of gently sloping Yahara silt loam. Also included were a few small areas of soils that are similar to Yahara silt loam but have clayey sediment at a depth ranging from 36 to 60 inches.

Natural fertility and organic-matter content are medium. The effective depth to which roots can penetrate is 40 inches or more. Runoff is slow, and wetness is the main limitation to use.

If surface drainage is used to remove excess water, this soil is suited to most crops commonly grown in the county. Most undrained areas are in permanent pasture. Capability unit IIw–2; woodland group 7; shrub and vine group C; wildlife group 5a.

Use and Management of the Soils

This section describes use and management of the soils of Brown County for crops and pasture. It also discusses woodland uses of the soils, gives the names of trees suitable for ornamental planting, and provides a guide for the planting of shrubs and vines. Next, the section discusses wildlife, describes uses of the soils for recreation, and explains engineering uses of the soils.

Management for Crops and Pasture

Crops commonly grown in Brown County are corn, oats, hay, and specialty crops. In addition, a large acreage is used for pasture. In the following pages basic practices are discussed for managing the soils for these commonly grown crops and for pasture, the system of capability classification is explained, and the capability units are described. Finally, predicted average acre yields of some of the principal crops under a high level of management are given.

Management of soils for crops

A successful farmer applies basic principles of soil management as they apply to his farming needs. He knows that it is important to maintain the soils in good tilth, to return organic matter to the soils, to furnish plant nutrients, and to control soil erosion. He must decide which basic practices are needed on his farm to achieve these goals. In addition, he must consider the number and kind of livestock he will own, the kind of machinery and related equipment needed, labor requirements, and the capital that is at his disposal. To help him to do this, the basic practices of good soil management as they apply to the soils of Brown County are discussed in the following paragraphs.

Maintaining favorable soil tilth.—Good tilth is needed for a good seedbed to insure uniform germination of seeds. The soil should be granular and firm so that it will enclose the seed completely and allow moisture to enter the seed readily. It must also remain friable so the young plant can emerge easily.

Such practices as keeping tillage to a minimum, adding organic matter, and growing grasses and legumes in the cropping system help to maintain or improve soil tilth. Excessive tillage and traffic by farm machinery and animals destroy soil tilth, especially when the soils are wet. Soils that are in poor tilth are more susceptible to soil blowing and water erosion than soils in good tilth. They puddle easily during a rain, and a crust forms on the surface as the soil dries out. Plow planting of corn and the control of weeds by chemicals will help to reduce the amount of damage caused by tillage and equipment.

Maintaining fertility.—As a result of the liming program carried out during the last 40 years in this area, reaction in the surface layer of most soils used for crops is nearly neutral. As the acidity is corrected, the plants are able to make better use of the other plant nutrients that are present in the soil or that are supplied by fertilizer. The amount of lime to apply depends upon the texture of the soil, the content of organic matter, the degree of acidity, and on the nutrient requirements of the crop to be grown.

Soil tests indicate whether plants will be benefited by applications of nitrogen, phosphorus, or potassium. A medium-to-high level of fertility should be maintained for good growth, and a good cover of vegetation should be maintained at the same time to protect the soil from erosion.

Planning a suitable cropping system.—In planning a cropping system, the soils of the entire farm should be considered. Soils that have few or only slight limitations to use for crops can be cropped intensively; that is, row crops can be grown year after year, or at least frequently, in relation to hay and small grain. These soils already have a good natural supply of plant nutrients, but response to applications of lime and fertilizer is good. The hazard of erosion is either nonexistent or is only slight. Soils that are steep, sandy, or wet are more limited in use than other soils. For these soils, it is important to use a cropping system that compensates for the limitations of the soils and protects them from damage.

Controlling erosion.—Most of the cultivated soils in this county are subject to erosion. The hazard of erosion ranges from slight to very severe. Different methods can be used to control erosion on different kinds of soil. One of the most effective is maintaining a good cover of plants or plant residue on the surface at all times. Other practices that can be used, either individually or in various combinations, are terracing, tilling on the contour, contour stripcropping, plow planting, establishing grassed waterways, and growing a sod cover crop during periods when erosion is most likely to occur.

Practices used to control soil blowing are stripcropping at right angles to the prevailing winds, stubble mulching, growing cover crops, and planting shelter belts.

Improving drainage.—Approximately a third of the acreage in the county is made up of somewhat poorly drained or poorly drained soils. Poor drainage limits the choice of plants that can be grown for crops. If suitable

outlets are available, most wet soils can be improved by drainage. Removing excess water rapidly makes it possible to use some of these soils more intensively and to use additional management practices. Drainage makes a soil more favorable for the growth of plants and beneficial soil bacteria.

Controlling weeds, insects, and plant diseases.—Damage to crops caused by weeds, insects, and plant diseases can be reduced by using a good cropping system, planting improved and resistant varieties of crops, tilling at the proper time, choosing the proper chemicals and applying them at the proper time and rate, and properly seeding the crop.

Management of soils for pasture

Rotation pastures and perennial, or permanent, pastures are the two types commonly used for grazing in Brown County. Rotation pastures are areas that are used for cultivated crops in some years and for pasture in 1 or more years as a part of the cropping system. Perennial pastures are occupied by perennial pasture plants or by self-seeding annuals but generally by both of these. This kind of pasture remains unplowed for many years. Management practices beneficial for these two kinds of pasture are discussed in the following paragraphs.

Rotation pasture.—For this kind of pasture, good management helps to provide forage of high quality and to maintain the vigor of the pasture plants. One of the goals in the management of grass-legume pastures is to maintain the legumes in the stand as long as possible. Suitable management practices for tame-grass pastures and for legume-grass pastures are listed below.

1. Delay grazing in spring until alfalfa and other upright legumes are 8 to 10 inches high, and Ladino clover and other prostrate legumes are 6 to 8 inches high. Also, delay grazing after prolonged rainy spells on clayey soils when they are saturated.
2. Divide the fields to provide rotational grazing. This allows time for the plants to recover between each grazing. Short grazing periods are better than long periods for legumes because there is less tramping and waste of forage and less soil compaction.
3. Remove animals when most of the plants have been grazed to a height of two inches.
4. Clip stubble if the pasture has been unevenly grazed or if tall grass is left in bunches that may smother the legumes.
5. Do not graze legume pastures between September 1 and October 10.
6. Topdress the established pastures, using the kind and amount of fertilizer needed as indicated by soil tests. Applying topdressing with nitrogen early in spring and delaying grazing until the grass is 4 inches tall are beneficial on grass pastures that contain no legumes.

Perennial pastures.—Certain grasses and legumes are well suited to specific kinds of soils as indicated by the yield predictions shown in table 2. Seeding legumes and well-suited grasses and using the practices listed below will improve perennial pastures.

1. Lime and fertilize according to the needs indicated by soil tests. Apply lime, if needed, several months before seeding; and apply fertilizer at the time of seeding.
2. Remove stones or other obstructions to facilitate preparation of the seedbed and use of future management practices.
3. Begin preparing the seedbed several months in advance of seeding to eliminate unwanted plant species and allow the lime, if applied, to work into the soil.
4. On sloping soils, work on the contour and leave mulch on the surface to lessen the hazard of erosion.
5. Inoculate the legume seed.
6. Use a small grain in the seeding mixture to help in controlling erosion. Graze the nurse crop when the plants are about 8 to 10 inches high to keep these plants from competing with young forage plants.
7. Do not allow grazing in a newly seeded pasture when the soils are wet. In established pastures delay grazing on wet soils in spring or after heavy rains until the soil becomes firm. Avoid overgrazing. Overgrazing sandy soils is particularly hazardous because these soils are droughty, and they produce a relatively thin cover of plants. Overgrazing makes them subject to soil blowing.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Brown County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–2 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Brown County are described, and suggestions are given for the use and management of the soils. The soils are identified only by the name of the series. Listing of the series name does not mean that all the soils of that series are in the particular unit. To find the classification of individual soils, refer to the "Guide to Mapping Units" at the back of this soil survey. The capability units are not numbered consecutively, because not all of the capability units used in Wisconsin are represented in this county.

CAPABILITY UNIT I–1

This unit consists of deep, nearly level, well-drained, silt loam soils that have a friable subsoil. These soils are in the Sisson and Waymor series. They are on glacial till plains and lacustrine plains.

These soils are moderately permeable and are easy to keep in good tilth. Available water capacity is high or medium, fertility is medium, and the content of organic matter is low. Reaction is neutral to moderately alkaline. Limitations to use of these soils for crops are slight.

The soils are suited to all the cultivated crops commonly grown in the county, and they are also well suited to pasture plants and hardwoods. Corn, oats, and alfalfa are the main crops, and in many places peas, beans, carrots, and table beets are grown on the Sisson soil.

The chief concerns of management are maintaining the content of organic matter and supply of plant nutrients and maintaining a favorable soil structure. Intensive management includes applying manure and other fertilizer, plowing under crop residue, and keeping tillage to a minimum. If the soils are managed intensively, they can be used for row crops year after year.

CAPABILITY UNIT IIe–1

This unit consists of deep, well-drained, gently sloping, loam and silt loam soils that have a friable subsoil. The soils are in the Casco, Hochheim, Sisson, and Waymor series. They are on glacial till plains and lacustrine plains.

These soils are moderately permeable and are medium in fertility. The available water capacity is low to high, and the organic-matter content is low. Reaction ranges from neutral to moderately alkaline. The hazard of erosion is slight or moderate.

These soils are suited to all the cultivated crops commonly grown in the county and are also well suited to pasture plants and hardwoods. Corn, oats, and alfalfa are the main crops. Peas, beans, carrots, and table beets are grown on the Sisson soils.

The chief concerns of management are the control of erosion and the maintenance of favorable soil structure, fertility, and organic-matter content. Suitable practices are adding manure and fertilizer, using crop residue, and keeping tillage to a minimum. Providing waterways and stripcropping help to control runoff and erosion. If the soils are managed intensively, row crops can be grown more frequently in the cropping system.

CAPABILITY UNIT IIe–2

This unit consists of moderately deep and deep, well-drained, gently sloping, loam and silt loam soils of the Kolberg, Onaway, and Solona series. These soils are on glacial till plains.

The soils have moderate to moderately slow permeability. Available water capacity is medium or high, fertility is medium to high, and the organic-matter content is low. Reaction is slightly acid to mildly alkaline. The hazard of erosion is slight or moderate. Droughtiness is a slight hazard on the Kolberg soils, and frost heaving is a slight hazard on the Onaway soils.

Soils of this unit are well suited to all the crops commonly grown in the county, and they are also suited to pasture plants and hardwoods. Corn, oats, and alfalfa are the main crops.

The chief management concerns are controlling erosion, maintaining the organic-matter content and supply of plant nutrients, and keeping the soils in good tilth. Adding manure and fertilizer, using crop residue, and keeping tillage to a minimum help to maintain an adequate supply of organic matter and plant nutrients. These practices also help to maintain soil structure. Contour stripcropping, waterways, and similar practices help to control runoff and erosion. If the soils are managed intensively, row crops can be grown more frequently in the cropping system.

CAPABILITY UNIT IIe–6

This unit consists of deep, well drained to moderately well drained, gently sloping, sandy loam or silty clay loam soils of the Briggsville, Kewaunee, and Oshkosh series. These soils are on glacial till plains and lacustrine plains.

Permeability in these soils is moderately slow or slow. The organic-matter content is medium or low, fertility is medium or high, and the available water capacity is high. Reaction is medium acid to mildly alkaline. The hazard of erosion is slight or moderate, and tilth generally is difficult to maintain where there is a surface layer of silty clay loam.

The crops commonly grown are corn, oats, and hay; but these soils are also well suited to pasture plants and hardwoods.

Using crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and good tilth. Waterways, land leveling, and contour stripcropping help to control runoff and erosion (fig. 13). If these management practices are used, row crops can be grown more frequently in the cropping systems.

CAPABILITY UNIT IIw–1

This unit consists of deep, nearly level, poorly drained, silt loam and silty clay loam soils of the Angelica, Pella, and Poygan series. These soils are in drainageways and depressions on glacial till plains and lacustrine plains. They have a firm subsoil.

Permeability is moderate to very slow, organic-matter content is medium or high, and fertility is medium or high. Available water capacity is medium or high. Reaction is slightly acid to moderately alkaline. These soils have a high water table and are subject to frequent ponding or flooding. Good tilth is difficult to maintain where there is a surface layer of silty clay loam.

The soils are suited to cultivated crops where flood protection and adequate drainage have been provided. Corn is the main crop, but in places oats and hay are grown. Unimproved areas are suited to pasture, trees, and wildlife habitat.

Surface or tile drains, or both, are used for drainage; and diversions provide some protection against overflow

Figure 13.—**Land leveling in a field of Kewaunee and Manawa soils. These soils are well suited to this practice.**

from adjoining slopes. Plowing under crop residue and applying manure and fertilizer help to maintain the content of organic matter and maintain fertility and good tilth. If the soils are managed intensively, row crops can be grown more frequently in the cropping system.

CAPABILITY UNIT IIw–2

This unit consists of deep, nearly level, somewhat poorly drained, sandy loam to silty clay loam soils of the Kibbie, Lamartine, Manawa, Solona, and Yahara series. These soils are in depressions and drainageways on glacial till plains and lacustrine plains. They have a friable or firm subsoil.

Permeability is moderate to slow. Fertility is medium or high, available water capacity is medium or high, and organic-matter content is medium or high. Reaction is neutral to moderately alkaline. The hazard of flooding is slight or moderate, and the soils have a seasonal high water table.

These soils are well suited to continuous row crops if they are protected from overflow and if adequate drainage is provided. Corn, oats, and hay are commonly grown. Cabbage is often grown on the Kibbie and Yahara soils. Unimproved areas are generally suited to pasture, trees, or wildlife habitat.

Applying manure, plowing under crop residue, and keeping tillage to a minimum help to maintain organic-matter content, fertility, and good tilth. Diversions help to provide overflow protection, and surface or tile drains provide adequate drainage. Where tile drains are used in the Kibbie and Yahara soils, care should be taken to prevent filling of the tile with sand and silt after installation.

CAPABILITY UNIT IIw–5

This unit consists of shallow or moderately deep, nearly level and gently sloping, somewhat poorly drained and poorly drained, sandy loam to silt loam soils. These soils are in the Bonduel; Fabius; Dresden, mottled subsoil variant; Sebewa; and Shullsburg, wet variant, series. They are on outwash plains that are underlain, in places, by limestone bedrock.

Permeability is moderate to slow. Available water capacity is low to medium, and the organic-matter content is medium or high. Fertility is medium. Reaction is slightly acid to moderately alkaline. The hazard of flooding is slight or moderate, and the hazard of wetness caused by the high water table is moderate to severe.

If the soils are drained and protected from flooding, they are suited to most crops commonly grown in the county. Corn, oats, and hay generally are the main crops. Unprotected areas are suited to pasture, trees, and wildlife habitat.

Keeping tillage to a minimum, using crop residue, and applying manure and fertilizer are practices that help to maintain the organic-matter content, fertility, and good tilth. Diversions provide flood protection, and surface drains provide control of the high water table. In places the presence of bedrock prohibits the installation of tile drains in the Bonduel, and Shullsburg, wet variant, soils.

CAPABILITY UNIT IIw–11

This unit consists of deep, moderately well drained to somewhat poorly drained, nearly level, silt loam soils of the Bellevue and Bellevue, mottled subsoil variant, series and the land type Alluvial land. The soils and land type are on stream benches and bottoms of alluvium that are subject to stream overflow.

Permeability is moderately slow to slow, available water capacity is high, organic-matter content is medium or high, and fertility is medium. Reaction is neutral to moderately alkaline.

The hazard of flooding is moderate or severe (fig. 14), and in areas of the Bellevue, mottled subsoil variant, the water table is high.

The soils and land type of this unit are suited to all crops commonly grown in the county if adequate flood protection is provided. Drainage is particularly important on the Bellevue, mottled subsoil variant, soils. In areas where intensive management practices are not used, the soils are suited to pasture, trees, and wildlife habitat.

Intensive management practices include applying manure, fertilizing, plowing under crop residue, and using minimum tillage to maintain organic-matter content, fertility, and structure. Open-ditch or surface drainage is beneficial for controlling the high water table. Diversions reduce the amount of runoff from adjacent slopes.

CAPABILITY UNIT IIs–1

This unit consists of moderately deep and deep, well-drained, nearly level loam and silt loam soils that have a friable subsoil. These soils are in the Dresden and Onaway series. They are on glacial till plains and outwash plains.

The available water capacity and the fertility of these soils are low to high. Permeability is moderate, and the organic-matter content is low or medium. Reaction is slightly acid to mildly alkaline. The hazard of drought is slight, but otherwise the soils are easy to maintain. The hazard of frost is slight on Onaway soils.

These soils are well suited to all crops commonly grown in this county. Corn, oats, and hay crops are the main crops. The soils are also suited to pasture plants and hardwoods.

The chief concerns of management are the maintenance of organic-matter content, fertility, good tilth, and moisture content. Applying manure and fertilizer, using crop residue, using good cropping systems, and keeping tillage to a minimum are good practices in an intensive management system for these soils.

CAPABILITY UNIT IIs–7

This unit consists of deep, well drained to moderately well drained, nearly level soils of the Oshkosh series. Texture is sandy loam, silt loam, or silty clay loam. These soils are on lacustrine plains.

Soils in this unit have a very firm subsoil, and permeability is slow. Organic-matter content is low, fertility is high, and the available water capacity is high. Reaction is medium acid to neutral. Good tilth generally is difficult to maintain where there is a surface layer of silty clay loam.

The main crop is corn, but oats and hay are also grown. These soils are also suited to pasture plants and hardwoods.

Plowing under crop residue and applying manure and fertilizer help to maintain organic-matter content, fertili-

Figure 14.—**Flooding in an area of soils of capability unit IIw–11.**

ty, and good tilth. Row crops can be grown more frequently in the cropping system if these management practices are used.

CAPABILITY UNIT IIIe–1

This unit consists of deep, well-drained, sloping, loam and silt loam soils of the Hochheim, Sisson, and Waymor series. These soils have a friable subsoil and are on glacial till plains and lacustrine plains.

The soils are moderately permeable and have medium fertility. Available water capacity is medium or high, and the organic-matter content is low. Reaction is neutral to moderately alkaline. The hazard of erosion is moderate.

These soils are suited to all crops commonly grown in the county. Corn, oats, and hay are the main crops. The soils are also well suited to pasture plants and hardwoods.

Keeping tillage to a minimum, returning crop residue to the soil, and adding manure and fertilizer are suitable practices. Waterways and contour stripcropping help to control runoff and erosion. Under a program of intensive management that includes these practices, desirable crops can be grown more frequently in the cropping system.

CAPABILITY UNIT IIIe–2

This unit consists of moderately deep and deep, sloping, well-drained soils of the Kolberg and Onaway series. Texture is sandy loam, loam, or silt loam. These soils are on glacial till plains that are underlain by bedrock in places. They have a friable subsoil.

These soils have moderate or moderately slow permeability and medium or high fertility. They have medium or high available water capacity and low organic-matter content. Reaction is slightly acid to moderately alkaline. Erosion and droughtiness are hazards, and frost heaving is a slight hazard on Onaway soils.

Soils of this unit are suitable for all crops commonly grown in the county. Corn, oats, and hay are the main crops. The soils are also suited to pasture plants and hardwoods.

Keeping tillage to a minimum and using crop residue, manure, and fertilizer help to maintain the organic-matter content, fertility, moisture content, and good structure. Waterways and contour stripcropping help to control runoff and erosion. With this type of intensive management a shorter rotation can be used with good results.

CAPABILITY UNIT IIIe–3

This unit consists of shallow, well-drained, gently sloping, loam and silt loam soils. They are in the Casco, Summerville, and Summerville, clayey subsoil variant, series. These soils are on outwash plains or glacial till plains. They have a friable subsoil.

Permeability is moderate to moderately slow, and organic-matter content is low. Available water capacity is low to very low, and fertility is medium. Reaction is neutral to mildly alkaline. The hazard of erosion is slight, and the hazard of drought is moderate to severe.

The soils are suited to oats, some hay plants, and other drought-resistant crops grown in the county. Corn is grown in places, and the soils are suited to pasture plants.

Plowing under crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and moisture content. Waterways and stripcropping help to control runoff and erosion.

CAPABILITY UNIT IIIe–4

This unit consists of deep, gently sloping, well-drained, loamy sand and sandy loam soils of the Manistee and Menominee series. These soils are on glacial till plains and lake basins. They have a loose subsoil.

Menominee soils have moderate permeability, and Manistee soils have rapid permeability in the sandy part of the profile and slow permeability in the lower part. Available water capacity in soils of this unit is medium, and fertility is low. Organic-matter content is low, and reaction is slightly acid to moderately alkaline. The hazard of erosion is slight, and the hazard of drought is moderate.

Oats and the more drought-resistant crops are suitable, but corn and hay are also grown. These soils are also suited to pasture plants and pine trees.

Plowing under crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and moisture content. Waterways and stripcropping help to control runoff and erosion. This type of intensive management will allow the use of a shorter crop rotation.

CAPABILITY UNIT IIIe–6

This unit consists of deep, well drained and moderately well drained, sloping, sandy loam and silt loam soils of the Kewaunee and Oshkosh series. These soils are on glacial till plains or ridges in lake plains. They have a very firm subsoil.

The soils have moderately slow or slow permeability and a low or medium organic-matter content. Fertility is medium to high, and the available water capacity is high. Reaction is medium acid to mildly alkaline. The hazard of erosion is moderate.

These soils are well suited to all crops commonly grown in the county. Corn, oats, and hay are the main crops. The soils are also suited to pasture plants and hardwoods.

Plowing under crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and good tilth. Waterways and stripcropping help to prevent runoff and erosion and make a shorter crop rotation practicable.

CAPABILITY UNIT IIIe–7

This unit consists of deep, sloping, loamy sand and sandy loam soils of the Boyer series. These soils are on outwash ridges. They have a friable subsoil.

Permeability is moderately rapid, and available water capacity is low. Fertility and organic-matter content are low, and reaction is medium acid to slightly acid. The soils are subject to moderate erosion and drought hazards.

These soils are suited to oats and other drought-resistant crops; but corn, hay, pasture plants, and pine trees are also suitable.

Plowing under crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and moisture content. Waterways and stripcropping help to control runoff and erosion and preserve moisture. Use of these management practices will make it possible to grow desired crops more frequently in the cropping system.

CAPABILITY UNIT IIIw–3

Only Keowns silt loam is in this unit. This soil is deep, poorly drained, and nearly level, and it has a friable subsoil. It is on lacustrine plains.

These soils have moderate permeability and medium organic-matter content. They have medium available water capacity and a medium fertility level. Reaction is mildly alkaline or moderately alkaline. The soils have a high water table, and the hazard of flooding is severe.

This soil is suitable for all crops commonly grown in the county if adequate drainage and flood protection are provided. Cabbage and corn are the main crops, but some oats and hay are grown. Unimproved areas are suited to pasture, trees, or wildlife habitat.

Fertilizing, keeping tillage to a minimum, and applying manure will help to maintain organic-matter content, fertility, and good tilth. Drainage can be provided by surface or tile drains or both. Where tile drains are used, measures should be taken to prevent the tile from filling with sand and silt after installation.

CAPABILITY UNIT IIIw–6

This unit consists of deep, nearly level, somewhat poorly drained and poorly drained sandy loam, loamy sand and silt loam soils of the Allendale, Ruse, and Wauseon series. These soils are on glacial till plains or lacustrine plains. They have a loose subsoil.

Permeability in the upper part of these soils is rapid or moderately rapid, and in the substratum it is slow. Organic-matter content is low or medium, and fertility is low. Available water capacity is low to medium, and reaction is slightly acid to moderately alkaline. These soils have a high water table and a moderate or severe hazard of flooding.

The soils are suited to all crops commonly grown in the county if adequate drainage and flood protection are provided. Corn, oats, and hay are the main crops. Unim-

proved areas are suited to pasture, trees, or wildlife habitat.

Applying manure and fertilizer and keeping tillage to a minimum help to maintain organic-matter content, fertility, and good tilth. Diversions help to provide flood protection, and surface or tile drains, or both, improve drainage. Where tile drains are used, measures should be taken to prevent clogging of the tile by soil material after installation.

CAPABILITY UNIT IIIw–8

This unit consists of moderately deep, nearly level, very poorly drained, mucky soils of the Ogden and Cathro series. These soils are in shallow glacial lake basins or depressions. They have a clayey or loamy substratum.

Permeability is moderately rapid in the upper part of these soils and moderate to slow in the substratum. Fertility is low, and the available water capacity is very high. Reaction is slightly acid to mildly alkaline. These soils have a high water table, and the hazard of flooding is severe. The hazard of frost heaving is moderate to severe.

These soils are suited to corn or truck crops if adequate drainage and flood protection are provided. Unimproved areas are suited to wetland pasture, trees, or wildlife habitat.

Surface or tile drains improve drainage. Diversions and channeling help to provide flood protection. Applying fertilizer and keeping tillage to a minimum are beneficial management practices.

CAPABILITY UNIT IIIw–9

Carbondale muck is the only soil in this unit. This deep, very poorly drained, and nearly level soil is in shallow lake basins and depressions in stream valleys.

This soil has moderately rapid permeability, and the available water capacity and organic-matter content are very high. Fertility generally is low. Reaction is slightly acid to neutral. The water table in this soil is high, and flooding is a severe hazard. This soil is difficult to cultivate because of the high water table and moderate to severe hazard of frost.

Undrained areas of this soil are better suited to wetland pasture or wildlife habitat than to other uses. If the soil is drained and protected from flooding, row crops can be grown frequently in the cropping system. Truck crops can be grown where the soil is managed intensively.

Keeping tillage to a minimum, applying fertilizer, and using drainage and flood protection measures are important intensive management practices. Drainage can be improved by using surface or tile drains. Diversions constructed on adjacent slopes will help to control runoff from sloping areas.

CAPABILITY UNIT IIIs–4

This unit consists of deep, gently sloping, well-drained, sandy loam and loamy soils of the Boyer and Dresden series. These soils are on outwash plains. They have a friable subsoil.

Permeability is moderate or moderately rapid. Organic-matter content is low to medium, fertility is low to moderate, and available water capacity is low. Reaction is medium acid to mildly alkaline. The soils have a slight to moderate hazard of drought and a slight hazard of erosion.

These soils are suited to oats and other drought-resistant crops grown in the county, but corn and hay are also commonly grown. The soils are also suited to pasture plants and hardwoods.

Plowing under crop residue and applying manure and fertilizer help to maintain organic-matter content, fertility, and moisture content. Waterways and stripcropping help to control runoff and erosion and preserve moisture. Use of intensive management that includes these practices will make it possible to grow row crops more frequently in the cropping system.

CAPABILITY UNIT IVe–1

This unit consists of deep, moderately steep, well-drained, loam and silt loam soils of the Onaway, Sisson, and Waymor series. These soils are on hillsides in glacial till plains and on ridges in lake plains. They have a friable subsoil.

Permeability is moderate, and organic-matter content is low. Fertility is medium, and available water capacity is medium or high. Reaction is slightly acid to moderately alkaline. The hazard of erosion is moderate or severe in areas that are not carefully managed.

The soils are better suited to hay than to row crops, but some row crops can be included in the cropping system if intensive management is used. The soils are also suitable for pasture plants and hardwoods.

Keeping tillage to a minimum, plowing under crop residue, and applying manure and fertilizer help to maintain the organic-matter content, fertility, and structure. Renovation, waterways, and contour stripping help to control runoff and erosion. If the soils are managed intensively, row crops can be grown more frequently in the cropping system.

CAPABILITY UNIT IVe–3

This unit consists of shallow, well-drained, sloping to moderately steep, loam soils of the Casco and Summerville series. These soils are on glacial till hillsides and outwash ridges. They have a friable subsoil. The Summerville soils are underlain by bedrock.

Permeability is moderate, available water capacity is low or very low, and fertility is low or medium. The organic-matter content is low. Reaction is neutral to mildly alkaline. The hazards of erosion and drought are moderate.

The soils are well suited to all crops commonly grown in the county, but they are better suited to crops that are more drought resistant. The soils are also suited to pasture plants and hardwoods.

Keeping tillage to a minimum, plowing under crop residue, fertilizing, and applying manure help to maintain organic-matter content, fertility, good tilth, and moisture content. Waterways, cropping systems, and stripcropping are other intensive management practices that help to prevent soil erosion and runoff.

CAPABILITY UNIT IVe–6

This unit consists of Kewaunee and Oshkosh soils and Sisson soils mapped in a complex with Kewaunee soils. These soils are deep, well-drained, sloping and moderately steep silt loams. They are on hillsides in glacial till plains and on ridges or sides of ravines in lake plains. The subsoil is firm.

Permeability is moderately slow or slow, and the organic-matter content is medium or low in areas of severely eroded soils. Fertility is medium or high, and available water capacity is high. Reaction is mildly acid to mildly alkaline. The hazard of erosion is moderate to severe. Tilth is poor in areas of eroded soils, and intensive management is required if these areas are cultivated.

These soils are suited to all crops commonly grown in the county. They are also suited to pasture plants and hardwoods.

Fertilizing, applying manure, and keeping tillage to a minimum help to maintain organic-matter content, fertility, and good tilth. Waterways, stripcropping, crop rotation, and renovation help to prevent soil erosion and runoff.

CAPABILITY UNIT IVe–7

This unit consists of deep, well-drained, moderately steep loamy sands of the Boyer series. These soils are on outwash ridges. They have a friable subsoil.

Permeability is moderately rapid, and fertility is low. Available water capacity is low, and organic-matter content is low. Reaction is medium acid to neutral. The hazards of erosion and drought are moderate. Intensive management helps to control erosion and conserve moisture in cultivated areas.

The soils are suited to the more drought-resistant crops, such as oats and hay; but they are also suited to pasture plants and pine trees.

Fertilizing, applying manure, and keeping tillage to a minimum help to maintain organic-matter content, fertility, and moisture content. Waterways, stripcropping, crop rotation, and renovation are other practices that help to prevent soil erosion and runoff.

CAPABILITY UNIT IVw–5

This unit consists of deep, nearly level, somewhat poorly drained and poorly drained, loamy sand soils of the Roscommon and Tedrow series. These soils are on outwash and lake plains. They have a loose subsoil.

Permeability is rapid. Fertility and available water capacity are low, and organic-matter content is low to high. Reaction is slightly acid to neutral. These soils have a high water table, and the hazard of flooding is severe. The hazard of frost is moderate.

The soils are suitable for most crops commonly grown in the county if adequate drainage and flood protection are provided. They are also suited to trees and for use as wildlife habitat.

Applying manure and fertilizer and plowing under crop residue are measures that help to maintain organic-matter content and fertility. Surface drains improve drainage, and diversions help to control runoff from adjacent slopes. Under a program of intensive management that includes these practices, desired crops can be grown more frequently in the cropping system.

CAPABILITY UNIT IVw–7

Markey muck is the only soil in this unit. This moderately deep, very poorly drained, nearly level soil is in depressions or on outwash plains.

Permeability is moderately rapid, the available water capacity is high, and organic-matter content is very high in this soil. Fertility is low, and reaction is medium acid to mildly alkaline. This soil has a high water table, and the hazard of flooding is severe. The hazard of frost is moderate, and the soil is subject to severe subsidence when drained.

This soil is suitable for most crops grown in the county if adequate drainage and flood protection are provided. It is better suited to trees and to wildlife habitat than to other uses.

Fertilizing and keeping tillage to a minimum help to maintain organic-matter content and fertility. Surface drains improve drainage, and channeling and diversions help to protect from flooding.

CAPABILITY UNIT IVs–3

This unit consists of deep, gently sloping and sloping; excessively drained loamy sand soils of the Manistee and Shawano series. These soils are on outwash and lacustrine plains. They have a loose subsoil.

Permeability is rapid in Shawano soils and rapid in the upper part of Manistee soils. It is slow, however, in the lower part of Manistee soils. Available water capacity, fertility, and organic-matter content are low in soils of this unit. Reaction is slightly acid to neutral. The hazard of drought is severe, and the hazard of soil blowing is moderate because of the sandy texture of these soils.

These soils are suited to the more drought-resistant crops, such as oats, and to pine trees. They are also suitable for irrigation if the tracts are large enough and if an adequate supply of water is available. If irrigation is used, a continuous row cropping system is suitable.

Applying manure and fertilizer and using crop residue are measures that help to maintain organic-matter content, fertility, and moisture. Shelterbelts provide protection from soil blowing.

CAPABILITY UNIT Vw–14

Only Alluvial land, wet, is in this capability unit. It consists of deep, wet, nearly level, stratified alluvium on bottom lands along streams and rivers.

The water table is high, and areas are subject to very severe and frequent flooding. Fertility generally is medium, available water capacity is high, and permeability is moderate. Reaction is neutral to moderately alkaline.

This land is suitable for wildlife habitat and for trees that are adapted to bottom-land areas. It is also suitable for pasture.

An important management practice on these soils is providing a good grass cover to help prevent severe flood damage. Protection from grazing is important in timber and wildlife habitat areas.

CAPABILITY UNIT VIe–3

Only the Casco-Rodman complex, 12 to 35 percent slopes, is in this unit. It consists of very shallow and shallow, well-drained, moderately steep and steep loamy soils on morainic ridges. These soils have a friable subsoil.

Fertility is low or medium, organic-matter content is low or medium, and the available water capacity of these soils is low or very low. Permeability is moderate to very rapid, and reaction is neutral to alkaline. The hazards of erosion and drought are severe.

These soils are better suited to pasture than to row

crops. They are also suitable for trees and as wildlife habitat. Renovation is beneficial for hay and pasture.

CAPABILITY UNIT VIe–6

This unit consists of deep, moderately steep and steep, well-drained soils of the Kewaunee and Oshkosh series. Texture is silt loam, silty clay loam, or clay. These soils are on hills on glacial till plains and ridges or on sloping sides of ravines in lake plains. They have a firm subsoil.

Permeability is moderately slow or slow, and organic-matter content is low or medium. Fertility is medium or high, and the available water capacity is high. These soils have a moderate or severe hazard of erosion. Those that have a surface layer of silty clay loam have poor tilth.

The soils are better suited to hay or pasture than to other uses. They are also suited to hardwoods and wildlife habitat. Renovation is beneficial for hay and pasture.

CAPABILITY UNIT VIe–7

This unit consists of deep, well-drained, steep, loamy sand soils of the Boyer series. The soils are on outwash ridges. They have a friable subsoil.

Permeability is moderately rapid, and organic-matter content is low. Available water capacity and fertility are low. The hazard of erosion is severe if the soils are cultivated. Droughtiness is a moderate hazard.

The soils are better suited to trees and wildlife habitat than to cultivated crops. They are also suited to the more drought-resistant pasture plants. Renovation is beneficial for pasture.

CAPABILITY UNIT VIs–3

This unit consists of deep, sloping, excessively drained loamy sand and fine sand soils of the Shawano series. These soils are on outwash ridges. They have a loose subsoil.

The fertility and available water capacity in these soils are low. The permeability is rapid, and the organic-matter content is low. Reaction is slightly acid to neutral. The hazards of erosion and drought are severe.

The soils are well suited to dry land pasture, pine trees, and wildlife habitat.

Wooded areas and wildlife habitat should be protected against grazing cattle. In cultivated areas applying manure and fertilizer and returning crop residue to the soil help to maintain organic-matter content, fertility, and moisture content.

CAPABILITY UNIT VIs–5

This unit consists of very shallow, well-drained, nearly level to moderately steep soils of the Namur series and very shallow, poorly drained, nearly level silt loams of the Namur series, wet variant. Bedrock is at a depth of 10 inches or less in these soils.

Fertility is low, and available water capacity is very low. Organic-matter content is medium or moderately low. Permeability is moderate, and reaction is mildly alkaline to moderately alkaline. The hazard of drought is very severe on the steeper slopes, and the hazard of erosion is severe. Namur, wet variant, soils have a high water table.

The soils are better suited to wildlife habitat or summer pasture than to other uses, but oats are grown in places on soils that are level or nearly level. Renovation is beneficial in pastures.

CAPABILITY UNIT VIIe–6

This unit consists of Rough broken land and deep, well-drained, steep and very steep clayey soils of the Kewaunee series. These soils are on hills and sloping sides of ravines on glacial till plains.

Permeability is moderately slow or slow, and the organic-matter content is low. Fertility is medium, and available water capacity is medium or high. Reaction is neutral to moderately alkaline. The hazards of erosion and soil slippage are severe.

The soils are better suited to wildlife habitat and hardwoods than to other uses. They are also suited to pasture on the lower slopes. Renovation is beneficial to pastures.

CAPABILITY UNIT VIIs–9

This unit consists of deep, excessively drained, sloping to steep, sandy soils of the Shawano series. These soils are in stabilized dune areas that in places have active blowouts.

The soils are very low in fertility and low in available water capacity. Organic-matter content is very low, and permeability is rapid. Reaction is slightly acid to neutral. If these soils are cultivated, the hazards of erosion and drought are severe.

The soils are better suited to pine trees than to other uses, but in places areas are in pasture. The pasture is also suitable as wildlife habitat. Renovation is beneficial for pastures, and protection from grazing is important in wooded and wildlife habitat areas.

CAPABILITY UNIT VIIIw–15

Only the land type Marsh is in this unit. It is mainly along the shores of Green Bay.

Marsh is too wet for cultivated crops or pasture; but sedges, rushes, and reeds grow well. The areas are well suited to wildlife habitat, hunting, fishing, trapping, and to recreational and esthetic uses. Many areas of Marsh can be improved by using dikes or ditches to control the water level.

CAPABILITY UNIT VIIIs–10

Only the land type Stony and rocky land is in this unit. It is very shallow and excessively drained and is underlain by limestone bedrock.

Permeability is moderate to rapid, and the organic-matter content, fertility, and available water capacity are low. Reaction is mildly alkaline to strongly alkaline. Stony and rocky land is droughty, and it generally is steep but ranges from nearly level to very steep.

These areas are better suited to wildlife habitat and trees than to other uses. Management for crops is difficult because of the shallow depth to bedrock. Where the areas are used for pasture, fertilizing is beneficial.

Predicted yields

Table 2 gives predicted long-term average yields per acre for each mapping unit in Brown County. The predictions are based on interviews with farmers; on actual yields obtained on test plots; and on the observations of soil scientists, district conservationists, extension workers, and other agricultural workers familiar with the soils of the county (*3*).

TABLE 2.—*Predicted average acre yields of principal crops*

[The land types Dumps (Du), Fill land (Fd), Gravel pits (Gp), Marsh (Mr), Quarries (Qu), Stony and rocky land (Sr) are omitted from this table. Absence of yield indicates the soil is not suited to the crop or that the crop ordinarily is not grown]

Soil	Corn for grain	Corn for silage	Oats [1]	Alfalfa-brome hay	Pasture, mainly bluegrass
	Bu	*Tons*	*Bu*	*Tons*	*A.U.D.* [2]
Allendale loamy fine sand, 0 to 3 percent slopes	75	12	60	3.5	100
Allendale fine sandy loam, 0 to 3 percent slopes	75	12	65	3.75	120
Alluvial land [3]	60	12	60	3.5	100
Alluvial land, wet [3]					110
Angelica silt loam	75	15	65	4.0	145
Bellevue silt loam [3]	80	12	75	4.0	150
Bellevue silty clay loam, mottled subsoil variant [3]	100	17	65		120
Bonduel loam, 0 to 3 percent slopes	80	15	70	3.5	120
Borrow pits				2.0	70
Boyer loamy fine sand, 2 to 6 percent slopes	70	12	55	2.5	80
Boyer loamy fine sand, 6 to 12 percent slopes, eroded	65	10	50	2.25	60
Boyer loamy fine sand, 12 to 20 percent slopes, eroded	60	9	45	2.0	60
Boyer loamy fine sand, 20 to 30 percent slopes				1.75	50
Briggsville silt loam, 2 to 6 percent slopes	85	14	70	4.0	150
Carbondale muck			65		95
Casco loam, 2 to 6 percent slopes	70	12	55	2.5	100
Casco loam, 6 to 12 percent slopes, eroded	60	8	45	2.0	80
Casco-Rodman complex, 12 to 35 percent slopes, eroded				2.0	70
Cathro muck	100	17	65		100
Dresden sandy loam, 1 to 3 percent slopes	75	12	60	3.0	130
Dresden sandy loam, mottled subsoil variant, 0 to 2 percent slopes	85	15	65	3.5	135
Dresden silt loam, 1 to 3 percent slopes	85	14	65	3.5	120
Dresden silt loam, mottled subsoil variant, 1 to 3 percent slopes	100	15	70	3.5	135
Fabius silt loam	95	14	55	3.0	150
Hochheim loam, 2 to 6 percent slopes	100	17	70	4.5	150
Hochheim loam, 6 to 12 percent slopes, eroded	90	15	65	4.0	120
Keowns silt loam	90	15	60	3.5	120
Kewaunee sandy loam, 2 to 6 percent slopes	75	12	70	4.0	135
Kewaunee sandy loam, 6 to 12 percent slopes, eroded	75	12	65	3.75	125
Kewaunee loam, gravelly substratum, 2 to 6 percent slopes	85	15	75	4.5	145
Kewaunee silt loam, 2 to 6 percent slopes	85	15	75	4.5	145
Kewaunee silt loam, 2 to 6 percent slopes, eroded	80	14	75	4.5	145
Kewaunee silt loam, 6 to 12 percent slopes, eroded	80	12	75	4.5	140
Kewaunee silt loam, 12 to 20 percent slopes, eroded	75	10	65	4.0	130
Kewaunee silt loam, 20 to 30 percent slopes, eroded				3.5	120
Kewaunee soils, 6 to 12 percent slopes, severely eroded	70	10	65	4.0	130
Kewaunee soils, 12 to 20 percent slopes, severely eroded				3.5	120
Kewaunee soils, 20 to 30 percent slopes, severely eroded				3.0	100
Kewaunee-Manawa complex, 2 to 6 percent slopes	85	15	75	4.5	145
Kewaunee-Manawa complex, 2 to 6 percent slopes, eroded	80	14	70	4.0	140
Kewaunee-Sisson complex, 15 to 30 percent slopes, eroded	75	10	65	4.0	130
Kibbie silt loam, 1 to 3 percent slopes	105	18	60	4.5	150
Kolberg silt loam, 1 to 6 percent slopes	85	15	65	3.5	120
Kolberg silt loam, 6 to 12 percent slopes, eroded	80	12	60	3.5	110
Lamartine silt loam, 0 to 3 percent slopes	115	18	65	4.0	150
Manawa sandy loam, 1 to 3 percent slopes	85	16	70	4.0	140
Manawa silty clay loam, 1 to 3 percent slopes	90	17	75	4.25	150
Manistee loamy fine sand, 2 to 6 percent slopes		10	60	3.0	60
Manistee loamy fine sand, 6 to 14 percent slopes, eroded		8	40	2.0	50
Manistee fine sandy loam, 2 to 6 percent slopes	65	12	65	3.0	70
Markey muck	80	13	60		80
Menominee loamy fine sand, 2 to 6 percent slopes	70	10	50	2.5	130
Namur silt loam, 1 to 6 percent slopes				2.0	40
Namur silt loam, 6 to 20 percent slopes				1.75	30
Namur silt loam, wet variant	30	8	35	1.0	40
Ogden muck	90	15	60		90
Onaway sandy loam, 2 to 6 percent slopes	80	14	65	3.5	140
Onaway sandy loam, 6 to 12 percent slopes, eroded	75	13	60	3.5	135
Onaway loam, 0 to 2 percent slopes	85	15	75	4.0	150
Onaway loam, 2 to 6 percent slopes	85	15	70	4.0	150
Onaway loam, 12 to 20 percent slopes, eroded	70	10	60	3.5	140
Onaway-Solona complex, 2 to 6 percent slopes	85	15	70	4.0	150
Oshkosh sandy loam, 0 to 2 percent slopes	85	15	75	4.5	140
Oshkosh sandy loam, 2 to 6 percent slopes	80	14	70	4.5	140
Oshkosh silt loam, 0 to 2 percent slopes	90	17	80	5.0	150

See footnotes at end of table.

TABLE 2.—*Predicted average acre yields of principal crops*—Continued

Soil	Corn for grain	Corn for silage	Oats [1]	Alfalfa-brome hay	Pasture, mainly bluegrass
	Bu	*Tons*	*Bu*	*Tons*	*A U D.*[2]
Oshkosh silt loam, 2 to 6 percent slopes	85	15	75	4. 5	150
Oshkosh silt loam, 6 to 12 percent slopes, eroded	80	13	70	4 0	125
Oshkosh silt loam, 12 to 20 percent slopes, eroded	75	12	65	4. 0	125
Oshkosh silt loam, 20 to 30 percent slopes, eroded				3. 5	80
Oshkosh silt loam, loamy substratum, 2 to 6 percent slopes	85	15	75	4 5	150
Oshkosh silty clay loam, 0 to 2 percent slopes	85	15	75	4. 5	150
Oshkosh silty clay loam, 2 to 6 percent slopes	80	15	70	4 5	145
Pella silt loam	115	18	65	4. 0	100
Poygan silty clay loam	105	18	65	4. 0	145
Rodman gravelly loam (In Casco-Rodman complex only)					50
Roscommon loamy fine sand	65	11	50	3. 0	60
Rough broken land					60
Ruse silt loam	70	11	55	3. 0	90
Sebewa silt loam	90	15	65	4. 0	70
Shawano fine sand, rolling				1. 0	40
Shawano fine sand, hilly				1. 0	40
Shawano loamy fine sand, 2 to 6 percent slopes	45	9	40	2. 0	80
Shawano loamy fine sand, 6 to 12 percent slopes				1. 75	60
Shullsburg silt loam, wet variant, 2 to 6 percent slopes	95	14	55	3. 5	115
Sisson fine sandy loam, 2 to 6 percent slopes	95	16	70	4. 5	150
Sisson fine sandy loam, 6 to 12 percent slopes, eroded	90	14	65	4. 0	120
Sisson fine sandy loam, 12 to 20 percent slopes, eroded			55	3. 5	120
Sisson silt loam, 0 to 2 percent slopes	100	18	75	4. 5	150
Sisson silt loam, 2 to 6 percent slopes	95	16	70	4. 5	150
Solona sandy loam, 1 to 3 percent slopes	95	17	60	3. 5	185
Solona loam, 1 to 3 percent slopes	100	18	65	4 0	140
Summerville loam, 1 to 6 percent slopes	70	12	65	3 5	80
Summerville loam, 6 to 20 percent slopes, eroded	70	12	65	3. 5	60
Summerville silt loam, clayey subsoil variant, 1 to 6 percent slopes	70	12	65	3. 5	80
Tedrow loamy fine sand, 0 to 3 percent slopes	55	9	45	2. 25	50
Wauseon fine sandy loam	85	14	60	3. 5	60
Waymor sandy loam, 2 to 6 percent slopes	90	15	70	4 5	140
Waymor silt loam, 0 to 2 percent slopes	100	17	75	4. 5	150
Waymor silt loam, 2 to 6 percent slopes	95	15	70	4. 5	145
Waymor silt loam, 6 to 12 percent slopes, eroded	90	15	70	4. 5	140
Waymor silt loam, 12 to 20 percent slopes, eroded	80	12	65	4 0	130
Waymor-Casco-Sisson complex, 3 to 12 percent slopes	90	15	70	4. 5	140
Waymor-Casco-Sisson complex, 12 to 25 percent slopes	80	12	65	4. 0	130
Yahara fine sandy loam, 0 to 3 percent slopes	75	13	50	3. 0	120
Yahara silt loam, 0 to 3 percent slopes	80	14	60	3. 5	130

[1] Yields were obtained where farmers planted the most disease-resistant varieties of crops and controlled the weeds.

[2] Animal-unit-days This is a term used to express the carrying capacity of pasture. It is the number of days the pasture can be grazed during a single grazing season without injury to the forage plants. An acre of pasture that can provide 30 days of grazing for two cows has a carrying capacity of 60 animal-unit-days.

[3] Adequate drainage and protection from flooding are required to obtain highest yields.

The yield values in Table 2 can be obtained when a high level of management is used. These practices characterize a high level of management: testing the soils to determine the kind and amount of fertilizer and the amount of lime to apply for maximum crop growth; using a suitable conservation cropping system; seeding, spraying, and cultivating at appropriate times; seeding hybrid corn at the rate of 16,000 to 18,000 plants per acre; planting improved varieties of small grain; planting a variety of alfalfa that is resistant to wilt and winterkill; topdressing hay crops annually with manure or with a commercial fertilizer high in potash; cutting hay crops three times a year; and not using the fields for grazing in fall. Even higher yields than those shown can be obtained from some soils through the use of special management practices.

Woodland and Community Planting

Before settlers arrived the area that is now Brown County was covered by forest, except for some marshy areas along Green Bay. On the uplands the virgin timber was mainly pine mixed with hardwoods, but pine was dominant.

As early as 1834, sawmills were operating throughout the county, and the area in forest was rapidly reduced. In 1871 a great fire raged out of control for 2 months and hastened the end of the lumber industry in Brown County. By 1959, only 46,300 acres, or about 14 percent of the county, remained in forest. The projected extent of the forested land that will remain by 1975 is about 41,000 acres. Acres of merchantable timber are primarily in the towns of Suamico, Morrison, and Hobart.

Several paper companies operate in Brown County, but much of the pulpwood needed by these companies is brought in from surrounding counties. A county reforestation camp has been established in the town of Suamico.

Woodland groups

The soils of Brown County have been grouped according to their suitability for producing various species of woodland shrubs and trees. The suitability ratings for these groupings were established by determining the texture and thickness of the soil and the degree of wetness. The woodland group for each mapping unit is shown in the "Guide to Mapping Units" and is noted at the end of the description of each mapping unit.

These woodland groups of soils are used as a basis for a general shrub and vine planting guide and a tree planting and selection guide. A discussion of the trafficability of the soils for equipment is included in the subsection "Use of the Soils for Recreation" under the heading of "Hiking Trails."

WOODLAND GROUP 1

In this group are moderately deep and deep, well drained and moderately well drained, medium-textured soils on uplands. These soils are in the Casco, Dresden, Hochheim, Onaway, Sisson, and Waymor series. The group also includes the land types Alluvial land and Rough broken land.

Native trees on these soils are mainly sugar maple, beech, oak, basswood, elm, and ash. Plantings of white pine, Norway pine, and white spruce grow well. Competition from brush, grass, and weeds is severe where adequate control measures are not applied. Herbicides can be used effectively on most sites.

The most suitable species for planting as windbreaks are white pine, white spruce, and white-cedar. Windbreak plantings of hardwoods generally have not been successful. Suitable trees planted for shade in yards and for recreational areas are sugar maple, beech, northern red oak, and white oak. For curbside planting along streets, the suitable species are hickory, basswood, ironwood, and white ash. White-cedar and redcedar are suited to use in hedges, screens, and windbreaks.

WOODLAND GROUP 2

In this group are moderately deep and deep, moderately well drained and well drained, medium-textured and fine-textured soils. These soils are in the Briggsville, Kewaunee, Kolberg, Oshkosh, and Sisson series.

Native trees on the soils in this group are mainly northern hardwoods. Competition from grass, brush, and weeds is a severe hazard to the establishment of tree seedlings. Soil cracking and the drying of tree roots during periods of drought cause some losses of seedlings. Frost heaving is common on these soils and may damage seedlings. Wetness frequently delays the planting of trees.

Suitable trees planted for shade are sugar maple, American beech, and white oak. Hickory, green ash, and ironwood are suitable species for planting along streets. White spruce, white-cedar, and redcedar are suited to use in hedges, screens, and windbreaks.

WOODLAND GROUP 3

In this group are moderately deep and deep, well drained to moderately well drained, coarse-textured soils that have a fine-textured substratum. These soils are in the Manistee series.

Native trees on the soils in this group are aspen, black oak, bur oak, and hickory. Competition from grass, brush, and weeds generally is not a concern, and seedlings are subject to little danger from frost. Damage to seedlings from heat or drought is severe in places on eroded soils and south slopes but is moderate on other sites.

A few native trees on these soils are especially suited to recreational or urban uses. Oak are suitable for shade trees, and ironwood trees are suitable for planting along streets. Redcedar, black locust, and cottonwood trees are suited to use in hedges, screens, and windbreaks.

WOODLAND GROUP 4

In this group are well-drained to excessively drained soils of the Boyer, Menominee, and Shawano series.

Seedling mortality from heat and drought is severe in these areas. Competition from grass, brush, and weeds is not siginficant.

Black oak and northern pin oak are native trees suitable for planting as shade trees. For plantings along streets, the hackberry is suitable. Redcedar and jack pine are suitable for hedges, windbreaks, and screens.

WOODLAND GROUP 5

In this group are shallow, somewhat droughty, medium-textured to moderately coarse textured soils of the Casco, Rodman, and Summerville series. The soils are underlain by bedrock or sand and gravel. The limited rooting zone restricts the development of tree roots and provides less available water-holding capacity than deeper soils.

Native trees on these soils are mainly oak, maple, basswood, and aspen. On drier and eroded sites, bur oak, black oak, and redcedar are common. Suitable trees planted for shade are red oak, white oak, sugar maple, and American beech. Hickory, green ash, and ironwood are suitable for planting along streets. Redcedar, white-cedar, white pine, and white spruce are suitable for hedges, screens, and windbreak.

WOODLAND GROUP 6

Soils in this group are the Namur series. They are very shallow over bedrock and are droughty. Tree growth on these soils is very slow, and the trees are scrubby, short boled, and poorly formed.

The native vegetation is mainly grass, bur oak, and redcedar. Redcedar is suitable for planting.

WOODLAND GROUP 7

In this group are somewhat poorly drained to poorly drained, medium-textured to fine-textured soils of the Allendale, Angelica, Bonduel, Dresden, mottled subsoil variant, Fabius, Keowns, Kibbie, Lamartine, Manawa, Namur, Pella, Poygan, Ruse, Sebewa, Shullsburg, wet variant, Solona, Wauseon, and Yahara series.

Native trees on the somewhat poorly drained soils are mainly mixed hardwoods, oak, and aspen. Soft maple, ash, and elm are the more common species on the poorly drained soils. White-cedar also grows in places.

Suitable shade trees on these soils are swamp white oak, red maple, and ash. Green ash, red maple, and basswood are suitable for planting along streets. White spruce and white-cedar are suitable for hedges, screens, and windbreaks.

WOODLAND GROUP 8

In this group are somewhat poorly drained to poorly drained, moderately coarse textured to coarse textured mineral soils of the Roscommon and Tedrow series.

Native vegetation on the soils in this group is oak, elm, ash, hickory, soft maple, grasses, and sedges. Willows grow in some places.

Silver maple is suitable for planting as a shade tree. Black ash can be planted along streets; and white-cedar is suitable for hedges, screens, and windbreaks.

WOODLAND GROUP 9

In this group are somewhat poorly drained to poorly drained alluvial soils of the Bellevue series. Alluvial land, wet, is also in this group.

Cottonweed trees grow well on the somewhat poorly drained sites, and willows are suitable for planting as streambank protection.

White oak and red maple are suitable for shade plantings. Ash is suitable for planting along streets; and white-cedar is suited to use in hedges, screens, and windbreaks.

WOODLAND GROUP 10

Peat and muck and other such organic soils of the Carbondale, Cathro, Markey, and Ogden series are in this group.

Native vegetation on these soils is mainly red maple, silver maple, elm, ash, white-cedar, willow, and sedges. Suitable trees planted for shade are silver maple, red maple, and white ash. White-cedar and willows are suitable for windbreaks, hedges, and screens.

WOODLAND GROUP 11

This group is made up mainly of Marsh, Stony and rocky land, and other land types that have very severe limitations to use for trees.

Selection of trees for woodland and ornamental planting

Timber production is now relatively unimportant in Brown County, but trees are a valuable resource where they are used for ornamental and protective plantings on soils of the various woodland suitability groups just discussed. Table 3, intended as a general guide, suggests the trees that are suitable for woodland planting and that can be grown for shade along streets and in parks, to beautify lawns and homes, and for planting in hedges, screens, and windbreaks. Coniferous trees generally are used for planting in new woodlands, but deciduous species should be favored for planting in existing stands.

Color of foliage, flowering and fruiting characteristics, resistance to injury from smoke, and susceptibility to disease have been considered in determining the species suitable for uses stated in table 3. Many horticultural varieties of trees that also are well adapted to the climate of Brown County are not included in the table. Information on horticultural varieties generally is available from nurserymen.

American elm, which is suited to many different soils and climates and was formerly used extensively as a shade tree, is not listed in table 3, because of its susceptibility to the Dutch elm disease.

Shrub and vine planting guide

Table 4 is a guide to the selection of shrubs and vines intended for use as hedges, ground cover, roadside beautification, and food and cover for wildlife. Only the more commonly used plants are listed in this table, and all the shrubs and vines shown are adapted to the climate of Brown County. Shrubs and vines suited to the better drained soils are also suited to soils that have poor natural drainage if those soils are improved by artificial drainage. Organic soils have severe limitations for many plants, even after they are drained.

Growth habits, shade tolerance, and esthetic features determine the suitability of plants for various uses and locations. Most plantings can accomplish more than one useful purpose if suitable plants are selected. For example, some shrubs and vines that have colorful foliage or berries can be as useful for wildlife food and cover as they are for hedges, screens, or landscaping.

The soils of Brown County are placed in four shrub and vine groups. Each of the groups is described below. The shrub and vine group for each mapping unit is given at the end of the description of the mapping units and also in the "Guide to Mapping Units."

Shrub and vine group A consists of soils that make up woodland groups 1, 2, and 3. These soils are deep and moderately deep, are well drained and moderately well drained, and consist of fine-textured to medium-textured or coarse-textured material over fine-textured material that has high available water capacity.

Shrub and vine group B consists of soils that make up woodland groups 4, 5, and 6. These soils are shallow or sandy, somewhat excessively drained or excessively drained, and have low available water capacity.

Shrub and vine group C consists of soils that make up woodland groups 7, 8, 9, and 10. These are somewhat poorly drained or poorly drained soils that have high available water capacity but do not have adequate supplementary drainage.

Shrub and vine group D consists of rocky and wet soils that make up woodland suitability group 11. These soils have severe limitations for plant growth and are not suitable for shrubs and vines. This group is not shown in table 4.

Planting.—Most shrubs are planted in spring before growth starts. Existing competition should be removed, and the shrub should be planted in a hole large enough to easily accommodate the roots. Soil should be packed around the roots and the plants should be watered adequately. Peat moss and fertilizer are frequently used. For best results, follow instructions that generally are provided with the plants.

TABLE 3.—*Tree selection guide for*

[The land types Borrow pits (Bp), Dumps (Du), Fill land (Fd), Gravel pits (Gp), and Quarries (Qu) are omitted from this table and from first letter refers to the ultimate height in feet of the tree S, less than 30 feet; M, 30 to 60 feet; and L, more than 60

Woodland group, description of soils, and mapping units in group	Trees for woodland—		Trees for ornamental planting as—	
			Shade trees	
	In sheltered coves and on slopes facing north and east	On exposed ridges and on slopes facing south and west	Sunny sites	Partly shaded sites
Group 1: Deep and moderately deep, well drained to moderately well drained, medium-textured soils on uplands. (Au, DdA, DrA, HoB, HoC2, OeB, OeC2, OhA, OhB, OhD2, OlB, Ro, ShB, ShC2, ShD2, SnA, SnB, WmB, WoA, WoB, WoC2, WoD2, WsC, WsE)	Sugar maple, basswood, white ash, black walnut, white pine, white spruce, white-cedar, red pine.	Red pine, white pine.	American beech (LO), sugar maple (LO), red maple (MO), red oak (LR), white oak (LR), basswood (LO), hackberry (MR), white ash (LO), sycamore (LO), bur oak (LR), Norway maple (MR), silver maple (LO), thornless honeylocust (MO).	American beech (LO), sugar maple (LO), red maple (MO), red oak (LR), hackberry (MR), white ash (LO), basswood (LO).
Group 2: Deep and moderately deep, well drained and moderately well drained, fine-textured soils. (BtB, KfB, KfC2, KgB, KhB, KhB2, KhC2, KhD2, KhE2, KkC3, KkD3, KkE3, KmE2, KoB, KoC2, OmA, OmB, OnA, OnB, OnC2, OnD2, OnE2, OoB, OsA, OsB)	Sugar maple, basswood, white ash, white pine, white spruce, white-cedar, Norway spruce.	White pine, white spruce.	Sugar maple (LO), red maple (MO), basswood (LO), American beech (LO), white oak (LR), white ash (LO), bur oak (LR), sycamore (LO), hackberry (MR), silver maple (LO).	American beech (LO), sugar maple (LO), red maple (MO), basswood (LO), white ash (LO), hackberry(MR).
Group 3. Moderately deep, coarse-textured soils that have a clayey substratum and are somewhat excessively drained (MeB, MeC2, MfB)	Red pine, white pine, white spruce, white ash.	Jack pine, red pine.	Scarlet oak (MO), bur oak (LR), hackberry (MR), black oak (LR), silver maple (LO), green ash (MO), thornless honeylocust (MO).	Hackberry (MR)--------
Group 4: Coarse-textured, excessively drained droughty soils. (BrB, BrC2, BrD2, BrE, MsB, SeC, SeD, SfB, SfC)	White pine, red pine	Redcedar, jack pine.	Black oak (LR), scarlet oak (MO), hackberry (MR), green ash (MO), silver maple (LO).	Hackberry (MR)--------

woodland and ornamental plantings

the woodland suitability groups because they are not suitable for trees. Letter symbols in parentheses have the following meanings. The feet. The second letter refers to the shape of the crown C, columnar; O, oval; P, pyramidal; Pe, pendulous; and R, round]

Trees for ornamental planting as—Continued					
Street trees		Lawn trees		Hedges, screens, and windbreaks	
Sunny sites	Partly shaded sites	Sunny sites	Partly shaded sites	Sunny sites	Partly shaded sites
Norway maple (MR), southern pin oak (MP), thornless honeylocust (MO), basswood (LO), white ash (LO), sugar maple (LO), hackberry (MR), red maple (MO).	Norway maple (MP), white ash (LO), basswood (LO), sugar maple (LO)	Flowering crab (SR), mountain-ash (SO), blue beech (SR), paper birch (MO), river birch (MO), Russian-olive (SR), southern pin oak (MP), serviceberry horse-chestnut (LR), Norway spruce (LP), red pine (LP), white pine (LP), white spruce (MP), black cherry (LO), blue spruce (LP), hawthorn (SR).	Blue beech (SP), serviceberry white pine (LP), white spruce (MP), blue spruce (LP), Norway spruce (LP).	Redcedar (SP), white-cedar (MC, P), white pine (LP), white spruce (MP), lombardy poplar (LC), Russian-olive (SR), upright yew (SP).	White-cedar (MC), white pine (LP), white spruce (MP), upright yew (SP).
Southern pin oak (MP), thornless honeylocust (MO), Norway maple (MR), hackberry (MR), white ash (LO), sugar maple (LO), red maple (MO), basswood (LO).	White ash (LO), Norway maple (MP), sugar maple (LO), basswood (LO).	Flowering crab (SR), paper birch (MO), blue beech (SR), mountain-ash (SO), black cherry (LO), white pine (LP), white-cedar (MC) southern pin oak (MP), white spruce (MP), Russian-olive (SR)	Blue beech (SR), white pine (LP), white spruce (MP), blue spruce (MP), mountain-ash (SO).	White-cedar (MC), redcedar (SP), lombardy poplar (LC), white spruce (MP), Russian-olive (SR), upright yew (SP).	White-cedar (MC), white spruce (MP), upright yew (SP).
Green ash (MO), white ash (LO), hackberry (MR), southern pin oak (MP), thornless honeylocust (MO).	Hackberry (MR)---	Flowering crab (SR), paper birch (MO), redcedar (SP), white pine (LP), white spruce (MP), red pine (LP), Russian-olive (SR).	White pine (LP), white spruce (MP).	Redcedar (SP), Russian-olive (SR), red pine (LP), white pine (LP), upright yew (SP), white spruce (MP).	Upright yew (SP), white pine (LP), white spruce (MP).
Hackberry (MR), green ash (MO).	Hackberry (MR)----	Red pine (LP), white pine (LP), Russian-olive (SR).	White pine (LP)----	Redcedar (SP), jack pine (MP), white pine (LP), Russian-olive (SR).	White pine (LP).

TABLE 3.—*Tree selection guide for woodland*

Woodland group, description of soils, and mapping units in group	Trees for woodland—		Trees for ornamental planting as—	
			Shade trees	
	In sheltered coves and on slopes facing north and east	On exposed ridges and on slopes facing south and west	Sunny sites	Partly shaded sites
Group 5: Thin (10 to 20 inches thick), somewhat excessively drained, medium-textured to moderately coarse textured soils. (CcB, CcC2, CdE2, SuB, SuD2, SvB)	White pine	Redcedar	Northern red oak (MO), white oak (LR), bur oak (LR), sugar maple (LO), red maple (MO), silver maple (LO).	Red oak (LR), sugar maple (LO), American beech (LO), red maple (MO).
Group 6: Very thin soils (0 to 10 inches thick) (NaB, NaD)	Not suited to most species of trees.	Not suited to most species of trees.	Not suited to most species of trees.	Not suited to most species of trees.
Group 7: Somewhat poorly drained to very poorly drained, medium-textured mineral soils on uplands (AdA, AeA, Ax, BnA, DeA, DsA, Fa, Ke, KlB, KlB2, KnA, LaA, MaA, McA, Ne, Pe, Po, Ru, Sb, SgB, SoA, SpA, Wa, YaA, YhA.)	White pine, white spruce, white ash, cottonwood (rooted cuttings), white-cedar	No exposed sites in this woodland group.	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO), white ash (LO), silver maple (LO), cottonwood (LO).	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO), white ash (LO).
Group 8: Somewhat poorly drained to very poorly drained, coarse-textured to moderately coarse textured soils. (Rs, TeA)	Cottonwood (rooted cuttings), white cedar.	No exposed sites in this woodland group.	Black ash (MC), silver maple (LO), cottonwood (LO), red maple (MO).	Red maple (MO)
Group 9: Somewhat poorly drained and poorly drained soils on alluvial flood plains (Aw, Bc, Bd)	Cottonwood (rooted cuttings), silver maple.	No exposed sites in this woodland group.	Swamp white oak (LR), red maple (MO), basswood (LO), hackberry (MR), green ash (MO), sycamore (LO), cottonwood (LO).	Swamp white oak (LR), hackberry (MR), red maple (MO), basswood (LO), green ash (MO).
Group 10 Peat and muck (Ca, Cm, Mk, Od)	Silver maple, white-cedar.	No exposed sites in this woodland group.	Silver maple (LO), red maple (LO).	Red maple (MO)
Group 11:[1] Unproductive land types. (Mr, Sr.)				

[1] These land types have variable characteristics, and they have severe limitations for the establishment and survival of trees.

and ornamental plantings—Continued

Trees for ornamental planting as—Continued					
Street trees		Lawn trees		Hedges, screens, and windbreaks	
Sunny sites	Partly shaded sites	Sunny sites	Partly shaded sites	Sunny sites	Partly shaded sites
Norway maple (MR), green ash (MO), red maple (MO), sugar maple (LO), thornless honeylocust (MO).	Norway maple (MP), sugar maple (LO), red maple (MO).	White pine (LP), paper birch (MO), Russian-olive (SR), flowering crab (SR).	White pine (LP), blue beech (SR).	Redcedar (SP), white pine (LP), white-cedar (MC), white spruce (MP), Russian-olive (SR).	White pine (LP), white-cedar (MC), white spruce (MP).
Not suited to most species of trees.	Not suited to most species of trees.	Not suited to most species of trees.	Not suited to most species of trees.	Redcedar (SP)------	Redcedar (SP).
Green ash (MO), basswood (LO), red maple (MO), southern pin oak (MP).	Green ash (MO), basswood (LO), red maple (MO).	White spruce (MP), paper birch (MO), mountain-ash (SO), weeping willow (M, Pe), white-cedar (MP), river birch (MO).	White spruce (MP), mountain-ash (SO).	White-cedar (MC), white spruce (MP), lombardy poplar (LC), laurel willow (MO).	White-cedar (MC), white spruce (MP).
Black ash (MC), red maple (MO), green ash (MO).	Red maple (MO)----	Mountain-ash (SO), weeping willow (M, Pe), paper birch (MO).	Mountain-ash (SO)--	White-cedar (MC), laurel willow (MO).	White-cedar (MC).
Southern pin oak (MP), red maple (MO), green ash (MO), basswood (LO).	Red maple (MO), basswood (LO), green ash (MO).	Paper birch (MO), white-cedar (MC), white spruce (MP), mountain-ash (SO), weeping willow (M, Pe).	White-cedar (MC), white spruce (MP), mountain-ash (SO).	White-cedar (MC), laurel willow (MO), lombardy poplar (LC).	White-cedar (MC), lombardy poplar (LC).
Red maple (MO), laurel willow (MO).	None----------	White-cedar (MC), white spruce (MP), weeping willow (M, Pe).	White-cedar (MC), white spruce (MP).	White-cedar (MC), laurel willow (MO).	White-cedar (MC).

TABLE 4.—*General shrub*

[The letter "X" means that the plant has the kind of characteristics,

Common name	Botanical name	Shrub and vine group	Type of plant	Growth characteristics			
				Potential height	Thorns	Shade tolerant	Thicket forming
				feet			
Arborvitae (shrub type)	*Thuja* species	A, B, C	Shrub	3–7			
Barberry, Japanese	*Berberis thunbergi*	A, B	Shrub	6	X	X	
Bayberry or waxmyrtle	*Myrica pensylvanica*	B, C	Shrub	5–9		X	
Bittersweet	*Celastrus scandens*	A, B	Vine			X	
Blackberry, dewberry, blackcap raspberry.	*Rubus* species	A, B	Bramble	1–5	X		X
Chokeberry, black	*Aronia melanocarpa*	A, B	Shrub	1–3		X	X
Cotoneaster	*Cotoneaster* species	A, B	Shrub	4–8			
Crabapple	*Malus* species	A, B	Shrub	10–25			
Currant, alpine	*Ribes* alpinum	A, B	Shrub	6–7		X	
Dogwood, gray	*Cornus racemosa*	A, B, C	Shrub	6–10		X	
Dogwood, pagoda	*Cornus alternifolia*	A, C	Shrub	10–15		X	
Dogwood, redosier	*Cornus stolonifera*	A	Shrub	3–9		X	X
Dogwood, roundleaf	*Cornus rugosa*	A, C	Shrub	3–9		X	
Dogwood, silky	*Cornus amomum*	A, C	Shrub	6–10		X	
Elder, American	*Sambucus canadensis*	A, C	Shrub	3–10			X
Filbert (hazelnut)	*Corylus americana*	A	Shrub	5–8		X	X
Forsythia	*Forsythia* species	A, B	Shrub	4–8		X	
Grape, wild	*Vitis* species	A, B	Vine			X	
Hawthorn or thornapple	*Crataegus*	A, B, C	Shrub	5–15	X	X	
Honeysuckle (shrub types)	*Lonicera* species	A, B, C	Shrub	6–12		X	
Juniper, creeping	*Juniperus* species	A, B	Shrub	1–2			
Juniper, Pfitzer	*J. chinensis pfitzeria*	A, B	Shrub	8–10			
Lilac	*Syringa* species	A, B	Shrub	8–10			X
Maple, Amur	*Acer ginnala*	A, B	Shrub	1			
Mockorange	*Philadelphus* species	A, B	Shrub	6–9			
Myrtle or periwinkle	*Vinca* minor	A, B	Vine	1		X	
Ninebark, common	*Physocarpus opulifolius*	A, B, C	Shrub	6–9		X	
Olive, autumn	*Elaeagnus umbellata*	A, B, C	Shrub	10–15		X	
Peashrub, Siberian	*Caragana arborescens*	A, B	Shrub	10–15			
Pine, mugho	*Pinus mugo mughus*	A, B	Shrub	6–9			
Plum, American	*Prunus americana*	A, B, C	Shrub	10–15	X	X	X
Privet, Amur	*Ligustrum amurense*	A, B	Shrub	10		X	
Privet, Regels border	*L. obtusifolium regelianum.*	A, B	Shrub	6–9		X	
Redcedar, eastern	*Juniperus, virginiana*	A, B	Shrub	6–9		X	
Rose, rugosa and horticultural varieties.	*Rosa* species	A	Shrub	2–6			
Russianolive	*Elaeagnus angustifolia*	A, B, C	Shrub	15+	X		
Snowberry	*Symphoricarpos* species	A, B	Shrub	3–4		X	X
Spirea, Anthony Waterer	*Spirea bumalda*	A, B	Shrub	2–3			
Spirea, narrow-leaf	*Spirea alba*	C	Shrub	3–4			
Spirea, vanhoutte	*Spirea vanhouttei*	A, B, C	Shrub	5–6		X	
Sumac, fragrant	*Rhus aromatica*	A, B	Shrub	3		X	X
Sumac, smooth	*Rhus glabra*	A, B	Shrub	6–10			
Sumac, staghorn	*Rhus typhina*	A, B	Shrub	10–15		X	X
Viburnum, American cranberry-bush.	*Viburnum trilobum*	A, C	Shrub	7–9		X	
Viburnum, arrowwood	*Viburnum dentatum*	A	Shrub	10–12		X	
Viburnum, blackhaw	*Viburnum prunifolium*	A, B	Shrub	8–10		X	
Viburnum, mapleleaf	*Viburnum acerifolium*	A, C	Shrub	3–5		X	
Viburnum, nannyberry	*Viburnum lentago*	A, B, C	Shrub	9–12		X	
Viburnum, rafinesque	*Viburnum rafinesquianum*	A, B	Shrub	2–4		X	
Viburnum, wayfaringtree	*Viburnum lantana*	A, B, C	Shrub	4–9		X	
Virginiacreeper	*Parthenocissus quinquefolia.*	A, B	Vine			X	
Wahoo, Eastern	*Euonymus atropurpureus*	A	Shrub	4–9		X	
Weigela	*Weigela* species	A	Shrub	4–8			
Willows, shrubby types including pussy willow.	*Salix* species	A, B, C	Shrub	2–8			
Winterberry, common	*Ilex verticillata*	A, C	Shrub	6–9		X	
Yew, shrub type	*Taxus* species	A	Shrub	3–10		X	

and vine planting guide

features, or suitability indicated by the column heading]

Esthetic features			Suitable for—					Remarks
Flowers	Berries	Leaves color in fall	Land-scaping	Hedge, screen, windbreak	Wildlife food and cover	Roadside planting	Ground cover	
		X	X	X	X			Slightly shade tolerant.
	X	X	X	X	X			
	X	X	X		X		X	
	X	X	X		X	X	X	Climbs.
X	X	X			X	X	X	
	X	X	X		X	X	X	
	X	X	X	X	X			
X	X	X	X	X	X	X		
X			X	X				Attractive foliage.
X	X	X			X	X		
X	X	X			X	X		
X	X	X						Some landscape value.
X	X	X			X	X	X	
X	X	X		X	X	X		
X	X				X	X	X	
	X	X			X	X		
X			X					
	X	X			X	X	X	Climbs.
	X	X			X	X		
X	X	X	X	X	X			
	X	X	X		X	X	X	Sharp-pointed leaves.
		X	X		X			
X			X	X		X		
		X	X	X				
X			X	X				
X			X			X	X	Forms mat on ground.
X		X	X	X		X		
	X	X	X	X	X			
	X	X		X	X	X		
		X	X		X			
X	X	X			X	X		
X	X	X			X			Some landscape value.
	X	X		X	X			Some landscape value.
				X				Some landscape value.
X	X	X	X		X	X		
	X	X	X	X	X			
	X	X	X		X	X	X	
X		X	X			X		
X		X						
	X	X	X	X	X	X	X	
	X	X			X	X		
X	X	X			X	X		Some landscape value.
X	X	X	X	X	X	X		Some landscape value.
X	X	X	X	X	X			
X	X	X		X	X	X		
X	X	X			X	X		
X	X	X		X	X	X		
X		X			X	X		
	X	X	X		X	X	X	Some landscape value; climbs.
	X	X	X		X	X		
X			X	X				
			X	X	X	X		
	X	X			X	X		
	X	X	X		X			

Spacing.—Because shrubs and vines grow to a larger size and tend to spread, it is desirable to plant them at least 3 feet from foundations and to provide ample distance from property lines. Plants need space in which to grow. Hedge plants can be spaced closer together. The following spacings are suggested as a general guide.

Ground cover (solid plantings)	3 feet x 3 feet
Hedges (one row)	2 to 3 feet apart in the row
Landscaping:	
Large shrubs (height 8 to 12 feet)	7 to 10 feet apart
Medium shrubs (height 5 to 8 feet)	5 to 7 feet apart
Small shrubs (height less than 5 feet)	2 to 5 feet apart
Screens, shrub windbreaks, and borders	4 feet apart in the rows; rows 4 feet apart
Roadsides (solid planting)	4 feet x 4 feet
Wildlife food and cover (clump plantings are encouraged, leaving half the area in grass):	
Food plants	10 feet x 10 feet
Cover plants	5 feet x 5 feet

Use of the Soils for Wildlife [2]

Successful management of wildlife on any tract involves having food, cover, and water available in a suitable combination. Lack of any of these necessities, an unfavorable balance between them, or inadequate distribution of them can seriously affect the usefulness of a tract as habitat for desired species of wildlife.

This section consists of descriptions of the wildlife groups in Brown County and describes six elements of wildlife habitat. It also contains two tables which show the value of wildlife elements for the important wildlife species in Brown County and give ratings of the suitability of the soils for producing the elements.

Wildlife suitability grouping of soils

The soils of Wisconsin have been placed in eight wildlife groups. Seven of these groups are represented in Brown County. They are as follows:

Group 1 consists of well drained and moderately well drained soils that are loamy throughout and not subject to flooding. These soils are in the Casco, Dresden, Hochheim, Kolberg, Menominee. Onaway, Sisson, and Waymor series; and the group also includes Fill land.

Group 2 consists of well drained and moderately well drained soils that have a clayey subsoil. The series represented are Briggsville, Kewaunee, Oshkosh, and Sisson.

Group 3 consists of the excessively drained soils that are sandy throughout and have only a shallow rooting depth for plants. The series represented are Boyer, Casco, Manistee, Rodman, and Shawano.

Group 5a consists of somewhat poorly drained soils in the Allendale, Bellevue, mottled subsoil variant, Bonduel, Dresden, mottled subsoil variants, Fabius, Kibbie, Lamartine, Manawa, Shullsburg, wet variant, Solona, Tedrow, and Yahara series.

Group 5b is made up of poorly drained soils of the Angelica, Keowns, Namur, wet variant, Pella, Poygan, Roscommon, Ruse, Sebewa, and Wauseon series; and it also includes Alluvial land, wet.

Group 6 consists of organic soils of the Carbondale, Cathro, Markey, and Ogden series; and it also includes Marsh.

Group 7 consists of the well drained and moderately well drained soils and land types that are subject to flooding. These are represented by soils of the Bellevue series and Alluvial land.

Group 8 consists of the droughty, stony, and rocky land types and of very shallow soils. Borrow pits, Dumps, Gravel pits, Quarries, Rough broken land, Stony and rocky land, and soils of the Namur and Summerville series make up this group.

The soils of wildlife group 2 are dominant in Brown County. They make up 43 percent of the county area. Group 2 soils are well suited to the plants required for wildlife habitat, but they are poorly suited to supplying the water requirements of wildlife. The soils of groups 5 and 6 are considered particularly suited to wildlife because a total of 21,250 acres of wetland is included. A wildlife area consisting of a mixture of soils of groups 2, 5, and 6 is desirable.

Listing the name of a series in a wildlife group does not mean that all the soils of that series are in that group. To find the mapping units in each of the wildlife groups, refer to the "Guide to Mapping Units" at the back of this survey. This information also is included at the end of each mapping unit description in the section "Descriptions of the Soils."

Habitat elements and soil suitability

Table 5 rates the relative value of habitat elements for important kinds of wildlife in Brown County. Table 6 rates the suitability of the soils in each wildlife group for producing the stated elements of wildlife habitat in adequate quantity and quality. In rating the soils for wildlife in table 6, the size, shape, or location of areas of soils and the pattern they form with other soils on the landscape were not considered. These factors must be considered, however, when a particular site is evaluated for its wildlife potential. Because of their mobility, wildlife make use of suitable habitat on numerous soils that are within the home range of the species.

In the paragraphs that follow, six elements of wildlife habitat are described, and the basis for rating soil suitability for producing desirable habitat is explained.

Grain and seed crops.—These are seed-producing annuals, including agricultural grains, planted to produce food for wildlife. Examples are corn, oats, sorghum, barley, and rye.

Criteria used as a basis for determining suitability of soils for producing these plants in kind and quantity needed by wildlife are susceptibility to flooding and erosion, slope, droughtiness, and fertility. Nearly level soils that have good available water capacity and moderate to high fertility are considered best suited to grain and seed crops.

Grasses and legumes.—These are domestic perennial grasses and herbaceous legumes that are established by planting and that furnish food and cover for wildlife. Examples are alfalfa, birdsfoot trefoil, red clover, sweetclover, and vetch.

Criteria used as a basis for determining suitability of

[2] By LAVERNE C. STRICKER, biologist, Soil Conservation Service.

soils for producing these plants in kind and quantity needed by wildlife are degree of wetness or droughtiness, relief, and susceptibility to flooding.

Wild herbaceous upland plants.—These are native or introduced perennial grasses and forbs (weeds) that provide food and cover mainly to upland forms of wildlife. They are established mainly through natural processes. Examples are prairie grasses, roundhead, lespedeza, beggar ticks, aster, and goldenrod.

Criteria used as a basis for determining suitability of soils for producing these plants in kind and quantity needed by wildlife are droughtiness, natural drainage, relief, susceptibility to flooding, and fertility.

Hardwood trees and shrubs.—These are trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs, or foliage used extensively by wildlife for food and cover. These are commonly established through natural processes, but they can be planted. Coniferous shrubs have about the same value for wildlife as hardwood shrubs for cover and are included in this category. Examples are viburnum, dogwood, hazelnut, oak, maple, and cherry.

Criteria used as a basis for determining suitability of soils for producing these plants in kind and quantity needed by wildlife are degree of wetness, droughtiness, susceptibility to flooding, relief, and competition from grasses.

Coniferous trees.—These are cone-bearing trees that are mainly important to wildlife as cover, but they can also furnish food in the form of browse, seeds, or fruitlike cones. These plants are commonly established through natural processes, but they can be planted. An open canopy is desirable. Examples are pine, fir, spruce, tamarack, and cedar.

Criteria used as a basis for determining suitability of soils for producing these plants in kind and quantity needed by wildlife are degree of wetness, relief, susceptibility to flooding, droughtiness, and competition from grasses.

Wetland food and cover plants.—These are annual and perennial, wild, herbaceous plants on moist and wet sites that produce food or cover for wetland forms of wildlife. Submerged and floating aquatic plants are not included in this group. Examples are smartweed, reed canarygrass, sedge, and sagittaria.

Criteria used as a basis for determining suitability of soils for producing a number of different kinds of these plants and the quantity needed by wildlife are degree of wetness or droughtiness, reaction, and relief. These soils are types 1 and 2 wetlands, which are defined by the U.S. Department of the Interior as seasonally flooded or saturated areas that generally are dry during the growing season (type 1) or are saturated but not covered during the growing season (type 2).

TABLE 5.—*Relative value of wildlife habitat elements for the important species of wildlife in Brown County*

[Numerals in columns have the following meanings: 1, the element has little or no value for the stated kind of wildlife; 2, the element has some value; 3, the element has an important value; 4, the element is very important to wildlife. An asterisk before a numeral means that the element is of key or critical importance to the kind of wildlife stated. A dash in the column means that the element is not applicable to maintenance of wildlife]

Important wildlife species	Grain and seed crops		Grasses and legumes		Wild herbaceous upland plants	Woody plants			Herbaceous wetland plants [1]	Water areas	
	Harvested	Unharvested	Harvested	Unharvested		Shrubs	Hardwood trees	Coniferous trees		Shallow water [2]	Deep water [3]
Migratory waterfowl:											
Ducks	3	3	1	3	3	---	1	---	*4	*4	4
Geese	4	4	4	1	---	---	---	---	2	3	4
Upland game birds:											
Hungarian partridge	4	4	3	4	4	1	---	---	1	---	---
Pheasant	4	4	---	*4	*4	4	---	1	*4	3	---
Ruffed grouse	1	1	1	2	2	*4	*4	3	---	---	---
Woodcock	---	---	1	3	3	4	4	2	3	---	---
Small game:											
Rabbits (cottontail)	3	4	3	*4	*4	*4	3	1	2	3	---
Raccoon	3	4	---	1	1	2	4	---	1	*4	4
Squirrels (fox and gray)	3	4	---	1	1	2	*4	1	---	---	---
Large game:											
Deer	3	4	3	3	4	4	4	4	3	3	2
Fur bearers											
Beaver	---	---	---	---	---	4	*4	---	4	4	*4
Fox (red) [4]	2	3	2	3	3	3	2	1	3	3	1
Mink [4]	---	---	---	---	---	2	1	1	3	*4	*4
Muskrat	1	1	---	---	---	1	---	---	4	*4	*4

[1] Type 1 and 2 wetlands, as described in text
[2] Type 3 and 4 wetlands, as described in text
[3] Type 5 wetlands, as described in text.
[4] Carnivorous species and not strictly dependent on elements listed

TABLE 6.—*Suitability rating of soil groups*

[Group 4 soils in the Wisconsin system are omitted

Wildlife soil group	Grain seed crops	Grasses and legumes	Wild herbaceous upland plants
Group 1. DdA, DrA, Fd, HoB, HoC2, KoB, KoC2, MsB, OeB, OeC2, OhA, OhB, OhD2, OlB, ShB, ShC2, ShD2, SnA, SnB, WmB, WoA, WoB, WoC2, WoD2, WsC, WsE	Good where slopes are 0 to 6 percent, fair where slopes are 6 to 12 percent; unstable where slopes are more than 12 percent, hazard of erosion.	Good where slopes are 0 to 12 percent, fair where slopes are 12 to 20 percent; unstable where slopes are more than 20 percent.	Good
Group 2: BtB, KfB, KfC2, KgB, KhB, KhB2, KhC2, KhD2, KhE2, KkC3, KkD3, KkE3, KlB, KlB2, KmE2, OmA, OmB, OnA, OnB, OnC2, OnD2, OnE2, OoB, OsA, OsB.	Good where slopes are 0 to 6 percent; fair where slopes are 6 to 12 percent; unstable where slopes are are more than 12 percent.	Good where slopes are 0 to 12 percent; fair where slopes are 12 to 20 percent; unstable where slopes are more than 20 percent.	Good where slopes are 0 to 20 percent; fair where slopes are more than 20 percent.
Group 3: BrB, BrC2, BrD2, BrE, CcB, CcC2, CdE2, MeB, MeC2, MfB, SeC, SeD, SfB, SfC	Fair where slopes are 0 to 6 percent; poor where slopes are more than 6 percent.	Good where slopes are 0 to 12 percent; fair where slopes are 12 to 20 percent; poor where slopes are more than 20 percent.	Good where slopes are 0 to 20 percent; fair where slopes are more than 20 percent.
Group 5a· AdA, AeA, Bd, BnA, DeA, DsA, Fa, KnA, LaA, MaA, McA, SgB, SoA, SpA, TeA, YaA, YhA	Good when drained; fair when undrained; seasonally wet	Good when drained; fair when undrained, seasonally wet; some species not suited.	Fair. seasonally wet; some species not suited.
Group 5b Aw, Ax, Ke, Ne, Pe, Po, Rs, Ru, Sb, Wa	Good when drained; unsuitable when undrained; wet soils.	Fair when drained, poor when undrained, wet soils; few species suited.	Poor: wet soils; few species suited
Group 6: Ca, Cm, Mk, Mr, Od	Fair where drained; unsuitable where not drained, soil too wet.	Fair where drained; unsuitable where not drained, soil too wet for most species.	Unsuitable soil too wet for most species
Group 7 Au, Bc	Good· hazards of water erosion and flooding.	Good	Good
Group 8 Bp, Du, Gp, NaB, NaD, Qu, CdE2, Rodman part, Ro, Sr, SuB, SuD2, SvB	Poor. droughty; shallow to rock; hazard of erosion	Fair where slopes are 0 to 12 percent; poor where slopes are more than 12 percent; droughty; some species not suited.	Fair· droughty; some species not suited.

for producing elements of wildlife habitat

because they do not occur in Brown County]

Woody plants		Wetland food and cover plants	Shallow and deep water developments
Hardwood trees and shrubs	Coniferous trees		
Good where slopes are 0 to 20 percent, fair where slopes are more than 20 percent.	Good where slopes are 0 to 20 percent; fair where slopes are more than 20 percent.	Poor where slopes are 0 to 2 percent, unstable where slopes are more than 2 percent; few species suited.	Poor where slopes are 0 to 2 percent; very poor where slopes are 2 to 30 percent; most soils have moderately permeable to rapidly permeable substrata.
Good where slopes are 0 to 20 percent; fair where slopes are more than 20 percent.	Good where slopes are 0 to 20 percent; fair where slopes are more than 20 percent.	Poor where slopes are 0 to 2 percent; unstable where slopes are more than 2 percent; few species suited.	Fair where slopes are 0 to 2 percent; poor where slopes are 2 to 30 percent; most soils have moderately slowly or slowly permeable substrata.
Good where slopes are 0 to 20 percent, fair where slopes are more than 20 percent.	Good where slopes are 0 to 20 percent, fair where slopes are more than 20 percent.	Poor where slopes are 0 to 2 percent; unstable where slopes are more than 2 percent; few species suited.	Very poor: moderately rapid to rapidly permeable; shallow to very porous substrata.
Fair: seasonally wet, some species not suited; grass competition.	Fair: seasonally wet, some species not suited, grass competition.	Fair where slopes are 0 to 2 percent, poor where slopes are more than 2 percent.	Good where slopes are 0 to 2 percent, fair where slopes are steeper, seasonally wet, slowly permeable substrata for about 50 percent of soils in this group; very rapid permeability in other soils.
Poor: wet soils, few species suited; grass competition.	Poor: wet soils, few species suited, grass competition.	Good: wet soils	Good
Poor: soil too wet for most species.	Fair: some species not suited	Good	Good.
Fair: hazard of flooding	Fair: hazard of flooding; some species not suited.	Poor: few species suited	Poor: variable permeability, hazard of flooding.
Poor: droughty, few species suited, grass competition.	Poor: droughty; grass competition, few species suited.	Unsuitable: droughty	Very poor: shallow to fissured dolomite, stony or variable conditions.

Ponds and shallow water developments.—These are impoundments or excavations for the control or maintenance of desired water levels for wildlife. The most suitable soils are nearly level and have a natural high water table or slow permeability. Many soils that have a high water table but that are also moderately to rapidly permeable are well suited to dug-out ponds. Onsite investigation is generally required for each development. The quality and quantity of water may vary considerably between sites, and this may be of great importance to wildlife (fig. 15).

Shallow water areas are types 3 and 4 wetlands. Type 3 wetlands are described by the U.S. Department of the Interior as shallow marshes in which the soil is saturated or covered by as much as 6 inches of water during the growing season. Type 4 wetlands are deep marshes that are covered by 6 inches to 3 feet of water during the growing season.

Deep water areas are type 5 wetland, described by the U.S. Department of the Interior as open water areas that include shallow ponds, reservoirs, or wet areas where water is less than 10 feet deep.

Use of the Soils for Recreation

The demand for land and facilities for outdoor recreational activities is increasing throughout the county. Such activities include picnicking, hiking, golfing, snowmobiling, and camping. Much of the land in Brown County is favorable for the development of recreational areas.

Soils information is basic for comprehensive planning and development of outdoor recreational areas. The soil properties that affect recreational uses are depth, slope, texture, stoniness, natural drainage, percolation rate, hazard of overflow, and the ability of the soil to sustain a load. The ratings in table 7 show the estimated limitations imposed by soil properties for stated recreational uses. Ratings used are *slight*, *moderate*, *severe*, and *very severe*. A rating of *slight* means that the soil has no limitations for a given use, or has limitations that are easy to overcome. A rating of *moderate* means that the soil has limitations for a given use that can be overcome by average management and careful design; a rating of *severe* means that the soil has limitations for a given use that are difficult to overcome; and a rating of *very severe* means that the soil has limitations that preclude its use for a given purpose.

Recreational uses for which soils are rated are described as follows:

Intensive play areas are those areas suitable for use as playgrounds, athletic fields, or tennis courts. Such uses require a level surface, good drainage, and good foot trafficability.

***Figure 15.*—Pond used by ducks and other kinds of wildlife in an area of Kewaunee and Oshkosh soils. Waterways that have properly designed structures provide good sites for ponds and wildlife plantings.**

Extensive recreational areas are those areas suitable for picnic sites, parks, nature study and conservation education areas, and for other nonintensive uses that allow for the random movement of people. These uses require fair drainage, good trafficability, and good ground cover (fig. 16).

Hiking trails must be suitable for use in cross-country hiking, for use as bridle and foot paths, and for use as nature trails and snowmobile trails. Good drainage, foot trafficability, favorable slope, and lack of stones are the principal considerations.

Golf course fairways are areas that require mild slopes and fair drainage. The soils must be able to support a good turf that can withstand close mowing and that has good trafficability.

Campsites are areas suitable for tents or trailers and for living activities for a limited time during the camping season. Little preparation is needed, but an attractive landscape and good foot trafficability are important.

Information related to use of soils for recreation is also given in the section "Engineering Uses of the Soils" and in the section "Woodland and Community Planting." Advice and assistance on seedbed preparation, soil and water conservation, and area plantings can be obtained from the local Soil Conservation Service office or from a landscape architect.

***Figure 16.*—Manmade lake used for recreation. A properly designed impoundment in a slowly permeable soil, such as a soil of the Kewaunee series, can do much to enhance a recreational area.**

TABLE 7.—*Estimated degree and kind of soil limitations to recreational uses*

[The following land types are omitted from this table because their properties are variable and generally require onsite investigation: Borrow pits (Bp), Dumps (Du), Fill land (Fd), Gravel pits (Gp), and Quarries (Qu). An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil and mapping symbols	Intensive play areas	Extensive recreational areas	Hiking trails	Golf course fairways	Campsites
Allendale. AdA AeA	Moderate seasonal high water table; leveling exposes sandy subsoil in places.	Moderate· seasonal high water table; water ponds for short periods in some places.	Moderate wet for moderate periods.	Moderate seasonal high water table; sites are wet for short periods.	Moderate. sites are wet for moderate periods.
Alluvial land Au---	Severe occasional flooding; slippery when wet	Moderate occasional flooding.	Moderate: occasional flooding; muddy and slippery when wet.	Moderate: occasional flooding: muddy and slippery when wet.	Severe· occasional flooding; slippery when wet.
Alluvial land, wet· Aw.	Severe· frequent flooding; poor trafficability; sod easily damaged when wet.	Severe: sites remain wet and soft for long periods; poor trafficability; frequent flooding.	Severe: poor trafficability; frequent flooding; wet for long periods.	Severe: poor trafficability; site remains wet and soft for long periods; turf easily damaged when wet; frequent flooding.	Very severe: site remains wet and soft for long periods; poor trafficability when wet; frequent flooding.
Angelica· Ax-------	Severe high water table; occasional flooding; poor trafficability when wet; sod easily damaged.	Severe: high water table; poor trafficability and sod easily damaged when wet; ponding may occur.	Severe high water table; wet for long periods; muddy and slippery when wet; difficult to maintain.	Severe. high water table; sites remain wet and soft for long periods; poor trafficability; turf easily damaged when wet.	Severe: sites remain wet and soft for long periods; poor trafficability when wet.
Bellevue Bc-------	Moderate· occasional flooding; muddy and slippery when wet.	Moderate occasional flooding	Moderate: occasional flooding.	Moderate: occasional flooding.	Severe: occasional flooding.
Bellevue, mottled subsoil variant: Bd.	Severe high water table; frequent flooding; poor trafficability; muddy and slippery when wet.	Severe frequent flooding; seasonal high water table.	Severe: frequent flooding; seasonal high water table; muddy and slippery when wet.	Severe· frequent flooding; seasonal high water table; turf easily damaged when wet.	Severe frequent flooding; seasonal high water table; muddy and slippery when wet.
Bonduel. BnA------	Moderate· seasonal high water table; poor trafficability when wet; extensive leveling exposes limestone in places.	Moderate. seasonal high water table; water ponds in low areas at times.	Moderate. wet for short periods; muddy and slippery when wet.	Moderate: seasonal high water table; turf easily damaged when wet; sites remain wet and soft for moderate periods.	Moderate: sites remain wet for moderate periods.
Boyer BrB, BrC2, BrD2, BrE	Moderate where slopes are 2 to 6 percent; severe on steeper soils; slightly droughty; sod difficult to maintain; erodible.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; slightly droughty; erodible	Slight where slopes are 2 to 12 percent; moderate where slopes are 12 to 20 percent; severe on steeper soils; erodible.	Moderate where slopes are 2 to 12 percent; severe on steeper soils; erodible; slightly droughty; difficult to maintain a good turf.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; erodible.

TABLE 7.—*Estimated degree and kind of soil limitations to recreational uses*—Continued

Soil and mapping symbols	Intensive play areas	Extensive recreational areas	Hiking trails	Golf course fairways	Campsites
Briggsville: BtB---	Moderate compacts easily and is muddy and slippery when wet; extensive leveling may expose clayey subsoil.	Slight erodible on slopes.	Moderate: muddy and slippery when wet; erodible.	Moderate: moderately slow permeability; sites remain wet and soft for short periods; turf easily damaged when wet.	Moderate. sites remain wet and soft for short periods; surface compacts easily.
Carbondale Ca---	Very severe. high water table; poor trafficability when wet; sod easily damaged; erodible.	Severe: high water table; poor trafficability and sod easily damaged when wet; water ponds for short periods in places.	Very severe· high water table; wet for long periods; poor trafficability; erodible; difficult to maintain.	Severe high water table; sites remain wet and soft for long periods; poor trafficability; erodible.	Very severe: sites remain wet and soft for long periods; poor trafficability.
*Casco CcB, CcC2, CdE2 (For Rodman part of CdE2, see Rodman series).	Moderate where slopes are 2 to 6 percent; severe on steeper soils; extensive leveling exposes sand and gravel substratum in places; erodible; slightly droughty.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; erodible.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; erodible.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; erodible.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; erodible.
Cathro Cm-------	Very severe high water table; occasional flooding; poor trafficability; sod easily damaged when wet; erodible.	Severe high water table; poor trafficability; sod easily damaged when wet; water ponds for short periods in places	Very severe high water table; wet for long periods; poor trafficability; erodible; difficult to maintain.	Severe· high water table; soils remain wet and soft for long periods, poor trafficability; sod easily damaged.	Very severe sites remain wet and soft for long periods; poor trafficability.
Dresden					
DdA---- ------	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent; severe on steeper soils.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils	Slight where slopes are 2 to 12 percent; moderate where slopes are 12 to 20 percent; severe on steeper soils.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils.
DrA----------	Moderate· erodible; extensive leveling exposes gravel substratum in places.	Slight· erodible----	Moderate erodible; muddy and slippery when wet.	Slight. erodible----	Moderate· surface compacts easily.
Dresden, mottled subsoil variant					
DeA----------	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent; severe on steeper soils.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent, severe on steeper soils	Slight where slopes are 2 to 12 percent; moderate where slopes are 12 to 20 percent, severe on steeper soils.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent; severe on steeper soils.
DsA----------	Moderate· sod easily damaged when wet; seasonal high water table.	Moderate· seasonal high water table, water ponds for short periods in some low areas.	Moderate wet for moderate periods; muddy and slippery when wet.	Moderate seasonal high water table, sites remain wet and soft for moderate periods; turf easily damaged when wet.	Moderate. sites remain wet for moderate periods.

TABLE 7.—*Estimated degree and kind of soil limitations to recreational uses*—Continued

Soil and mapping symbols	Intensive play areas	Extensive recreational areas	Hiking trails	Golf course fairways	Campsites
Fabius: Fa	Moderate: seasonal high water table.	Moderate· seasonal high water table.	Slight· trails and paths are wet for short periods in places.	Moderate· seasonal high water table; heavy foot traffic may damage during wet periods.	Moderate· seasonal high water table; sites remain wet for short periods; walks and roads should be surfaced.
Hochheim· HoB, HoC2	Moderate where slopes are 2 to 6 percent; severe where slopes are steeper; erodible, stony in places	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; erodible; stony in places	Slight. erodible	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; stony in places.	Slight where slopes are 2 to 6 percent, moderate where slopes are 6 to 12 percent; erodible; stony in places.
Keowns Ke	Severe: occasional flooding; poor trafficability; sod easily damaged when wet.	Severe sites remain wet for long periods; poor trafficability, occasional flooding.	Severe: wet for long periods; poor trafficability when wet	Severe: site remains wet and soft for long periods; turf easily damaged when wet.	Severe· sites remain wet for long periods; poor trafficability when wet.
*Kewaunee: KfB, KfC2	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent; severe on steeper soils	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils.	Slight where slopes are 2 to 12 percent; moderate where slopes are 12 to 20 percent; severe on steeper soils	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent; severe on steeper soils	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent; severe on steeper soils
KgB, KhB, KhB2, KhC2, KhD2, KhE2, KkC3, KkD3, KkE3, KlB, KlB2, KmE2 For Manawa part of KlB and KlB2, see Manawa series. For Sisson part of KmE2, see Sisson series.	Severe: slow permeability, compacts easily and is muddy and slippery when wet, leveling will expose clayey subsoil.	Slight where slopes are 2 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils; erodible	Moderate where slopes are 2 to 12 percent; severe on steeper soils, muddy and slippery when wet; erodible.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils, moderately slow to slow permeability; sites remain wet and soft for short periods	Moderate where slopes are 2 to 12 percent; severe on steeper soils Sites remain wet and soft for short periods, erodible
Kibbie KnA	Moderate: seasonal high water table, compacts easily and is muddy and slippery when wet	Moderate· seasonal high water table, compacts easily when wet; water ponds for short periods in some low areas.	Moderate. wet for moderate periods, muddy and slippery when wet, erodible.	Moderate: seasonal high water table; sites remain wet and soft for moderate periods; turf easily damaged when wet.	Moderate· sites remain wet and soft for moderate periods, erodible.
Kolberg KoB, KoC2	Moderate where slopes are 0 to 2 percent; severe on steeper soils; compacts easily; muddy and slippery when wet; extensive leveling exposes limestone in places	Slight where slopes are 0 to 6 percent, moderate on steeper soils; erodible.	Moderate muddy and slippery when wet; erodible.	Slight where slopes are 0 to 6 percent; moderate on steeper soils; erodible.	Moderate· sites remain wet and soft for short periods, erodible.

TABLE 7.—*Estimated degree and kind of soil limitations to recreational uses*—Continued

Soil and mapping symbols	Intensive play areas	Extensive recreational areas	Hiking trails	Golf course fairways	Campsites
Lamartine LaA	Moderate seasonal high water table; compacts easily and is muddy and slippery when wet	Moderate seasonal high water table, compacts easily when wet, water ponds for short periods in some low areas	Moderate. wet for moderate periods; muddy and slippery when wet	Moderate seasonal high water table, sites remain wet and soft for moderate periods; turf easily damaged when wet	Moderate sites remain wet and soft for moderate periods
Manawa MaA, McA.	Moderate· seasonal high water table; slow permeability; extensive leveling will expose clayey subsoil.	Moderate: seasonal high water table; water ponds for short periods in places.	Moderate: wet for moderate periods; muddy and slippery when wet.	Moderate· seasonal high water table; sites remain wet and soft for moderate periods; turf easily damaged when wet.	Moderate· sites remain wet and soft for moderate periods
Manistee· MeB, MeC2, MfB.	Moderate where slopes are 2 to 6 percent; severe on steeper soils; droughty; erodible; leveling exposes clay substratum in places.	Moderate droughty; erodible.	Moderate· erodible; poor stability on slopes	Moderate erodible; droughty; difficult to maintain turf.	Moderate erodible; droughty; hard to maintain vegetative cover.
Markey muck· Mk.	Very severe· high water table; poor trafficability; water ponds for short periods in places	Severe high water table; poor trafficability; water ponds for short periods.	Very severe: high water table; wet for long periods; poor trafficability; difficult to maintain	Severe high water table; sites remain wet and soft for long periods; poor trafficability; turf easily damaged when wet.	Very severe· high water table; poor trafficability.
Marsh Mr	Very severe flooded most of the year.	Very severe· flooded most of the year.	Very severe flooded most of the year.	Very severe: flooded most of the year; used as ponds in places; hazards, or water for irrigation.	Very severe· flooded most of the year
Menominee MsB	Moderate· slightly droughty; difficult to maintain a good sod; extensive leveling exposes clayey substratum in places.	Moderate slightly droughty; erodible; difficult to maintain good sod.	Moderate. erodible; poor stability on slopes; difficult to maintain.	Moderate: erodible; slightly droughty; difficult to maintain good turf.	Moderate slightly droughty; erodible; adequate vegetative cover hard to maintain.
Namur NaB, NaD	Severe. leveling will expose bedrock; droughty; difficult to maintain good sod	Moderate where slopes are 0 to 6 percent; severe on steeper soils; erodible on sloping areas; droughty.	Moderate. erodible on sloping areas; stony in places	Moderate where slopes are 0 to 6 percent; severe on steeper soils; difficult to maintain good turf; droughty; stony in places.	Moderate: droughty; difficult to maintain sod
Namur, wet variant Ne.	Severe high water table; subject to ponding	Severe high water table; subject to ponding.	Severe subject to ponding; poor trafficability when wet.	Severe subject to ponding; poor trafficability when wet.	Severe high water table; subject to ponding.
Ogden. Od	Very severe· high water table, occasional flooding, poor trafficability; sod easily damaged when wet; erodible.	Very severe high water table; poor trafficability, sod easily damaged when wet; water ponds for short periods in places.	Very severe: high water table; wet for long periods; poor trafficability; erodible, difficult to maintain.	Severe: high water table; sites remain wet and soft for long periods, poor trafficability, sod easily damaged.	Very severe sites remain wet and soft for long periods, poor trafficability.

TABLE 7.—*Estimated degree and kind of soil limitations to recreational uses*—Continued

Soil and mapping symbols	Intensive play areas	Extensive recreational areas	Hiking trails	Golf course fairways	Campsites
*Onaway OeB, OeC2, OhA, OhB, OhD2, OlB For Solona part of OlB, see Solona series.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent, severe on steeper soils, erodible, stony in places.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils, erodible.	Slight where slopes are 0 to 12 percent, moderate on steeper soils, erodible, often stony.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent; severe on steeper soils, erodible, often stony.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils; erodible often stony.
Oshkosh OmA, OmB	Slight where slopes are 0 to 2 percent, moderate where slopes are 2 to 6 percent, severe on steeper soils.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils, slow permeability, erodible.	Slight where slopes are 2 to 12 percent, moderate where slopes are 12 to 20 percent, severe on steeper soils.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent; severe on steeper soils, slow permeability, sites remain wet and soft for short periods	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils.
OnA, OnB, OnC2, OnD2, OnE2, OoB, OsA, OsB	Moderate where slopes are 0 to 2 percent, severe on steeper soils, slow permeability, compacts easily, muddy and slippery when wet; leveling will expose clayey subsoil.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils, slow permeability, erodible.	Moderate where slopes are 0 to 12 percent; severe on steeper soils, muddy and slippery when wet, erodible	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils, slow permeability, sites remain wet and soft for short periods.	Moderate where slopes are 0 to 12 percent, severe on steeper soils, sites remain wet and soft for short periods, surface compacts easily.
Pella Pe	Severe high water table, occasional flooding; poor trafficability, sod easily damaged, muddy and slippery when wet.	Severe high water table, poor trafficability, sod easily damaged when wet; water ponds for short periods in places.	Severe high water table, wet for long periods; poor trafficability, muddy and slippery when wet.	Severe high water table, sites remain wet and soft for long periods; poor trafficability, turf easily damaged when wet.	Severe sites remain wet and soft for long periods, poor trafficability when wet.
Poygan Po	Severe high water table, occasional flooding; poor trafficability, sod easily damaged when wet; slow permeability.	Severe high water table, poor trafficability, occasional flooding, sod easily damaged when wet; slow permeability.	Severe high water table, wet for long periods; muddy and slippery when wet; poor trafficability when wet.	Severe high water table, sites remain wet and soft for long periods, poor trafficability when wet, turf easily damaged when wet.	Severe sites remain wet and soft for long periods, poor trafficability when wet.
Rodman (Mapped only in a complex with Casco soils)	Severe droughty; difficult to maintain good sod; leveling exposes stony and cobbly substratum in places.	Severe droughty; erodible; difficult to maintain good sod; often stony	Severe droughty; erodible; often stony or gravelly	Severe droughty; gravelly, difficult to maintain good turf.	Severe droughty; erodible; often stony or gravelly.
Roscommon Rs	Severe high water table; occasional flooding; erodible; sod easily damaged when wet.	Severe high water table; water may pond for short periods; erodible	Severe high water table; wet for long periods, erodible.	Severe high water table; sites remain wet for long periods; erodible; sod easily damaged.	Severe sites remain wet for long periods; erodible.

TABLE 7.—*Estimated degree and kind of soil limitations to recreational uses*—Continued

Soil and mapping symbols	Intensive play areas	Extensive recreational areas	Hiking trails	Golf course fairways	Campsites
Rough broken land Ro	Very severe very steep slopes.	Very severe. very steep slopes	Severe· very steep slopes; difficult to maintain; muddy and slippery when wet.	Very severe: very steep slopes; difficult to maintain turf.	Very severe very steep slopes
Ruse Ru	Severe high water table; subject to flooding	Severe high water table; subject to flooding	Severe high water table; muddy and slippery when wet	Severe high water table; turf easily damaged when wet	Severe· high water table; subject to flooding.
Sebewa Sb	Severe high water table; subject to flooding; poor trafficability; sod easily damaged when wet.	Severe· high water table; subject to flooding and ponding for short periods.	Severe· high water table; wet for long periods; poor trafficability when wet.	Severe· high water table; wet and soft for long periods; poor trafficability; turf easily damaged when wet	Severe: sites remain wet for long periods.
Shawano SeC, SeD	Severe droughty; difficult to maintain good sod; erodible; extensive leveling will expose sandy substratum.	Very severe	Severe	Moderate where slopes are 0 to 6 percent; severe on steeper soils; erodible; droughty; difficult to maintain a good turf	Moderate where slopes are 2 to 6 percent; severe on steeper soils; erodible; droughty; adequate vegetative cover hard to maintain
SfB, SfC	Severe droughty; difficult to maintain good sod; erodible; extensive leveling exposes sandy substratum	Moderate where slopes are 2 to 6 percent; severe on steeper soils, droughty; difficult to maintain good sod; erodible.	Moderate where slopes are 2 to 12 percent; severe on steeper soils; erodible; poor stability on slopes; difficult to maintain.	Moderate where slopes are 0 to 6 percent; severe on steeper soils; erodible; droughty; difficult to maintain a good turf.	Moderate where slopes are 2 to 6 percent; severe on steeper soils; erodible; droughty; adequate vegetable cover hard to maintain.
Shullsburg, wet variant SgB	Severe seasonal high water table; compacts easily when wet; extensive leveling exposes shale bedrock in places.	Moderate· seasonal high water table; water ponds for short periods in some low areas	Moderate wet for moderate periods; muddy and slippery when wet; erodible.	Moderate· seasonal high water table; slow permeability; sites remain wet and soft for moderate periods; turf easily damaged when wet.	Moderate. sites remain wet for moderate periods
Sisson ShB, ShC2 ShD2.	Slight where slopes are 0 to 2 percent, moderate where slopes are 2 to 6 percent, severe on steeper soils.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent; severe on steeper soils, erodible.	Slight where slopes are 2 to 12 percent; moderate where slopes are 12 to 20 percent, severe on steeper soils.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent, severe on steeper soils, erodible.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils.
SnA, SnB	Moderate where slopes are 0 to 6 percent; severe on steeper soils, compacts easily, muddy when wet, erodible.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, severe on steeper soils, erodible.	Moderate where slopes are 0 to 12 percent, severe on steeper soils, muddy and slippery when wet, erodible and poor stability.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent; severe on steeper soils, erodible.	Moderate where slopes are 0 to 12 percent, severe on steeper soils; erodible.

TABLE 7.—*Estimated degree and kind of soil limitations to recreational uses*—Continued

Soil and mapping symbols	Intensive play areas	Extensive recreational areas	Hiking trails	Golf course fairways	Campsites
Solona: SoA, SpA	Moderate: seasonal high water table, sod easily damaged when wet; stony or cobbly in places.	Moderate: seasonal high water table, water ponds for short periods in some low areas.	Moderate wet for moderate periods	Moderate seasonal high water table; sites remain wet and soft for moderate periods, turf easily damaged when wet; stony in places.	Moderate sites remain wet and soft for moderate periods; stony or cobbly in places.
Stony and rocky land: Sr.	Very severe rocks cover more than 90 percent of surface.	Very severe: rocks cover more than 90 percent of surface.	Very severe rocks cover more than 90 percent of surface.	Very severe: rocks cover more than 90 percent of surface.	Very severe: rocks cover more than 90 percent of surface.
Summerville SuB, SuD2.	Severe: leveling exposes bedrock in places.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; erodible, stony or rocky in places.	Slight erodible; stony or rocky in places.	Moderate thin over bedrock; erodible, stony or rocky in places.	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils, erodible, stony or rocky in places.
Summerville, clayey subsoil variant SvB	Severe bedrock restricts development.	Slight erodible, stony or rocky in places.	Slight erodible, stony or rocky in places, slippery and muddy when wet.	Moderate: thin over bedrock, erodible; stony or rocky in places.	Moderate erodible; stony or rocky in places.
Tedrow: TeA	Moderate seasonal high water table, erodible, sod easily damaged when wet.	Moderate: seasonal high water table, water ponds for short periods in some low areas.	Moderate: wet for moderate periods, erodible.	Moderate seasonal high water table; sites remain wet for moderate periods, erodible.	Moderate: sites remain wet for moderate periods; erodible.
Wauseon Wa	Severe: high water table; poor trafficability; sod easily damaged when wet	Severe high water table; water ponds for short periods in places	Severe high water table; wet for long periods	Severe high water table; sites remain wet for long periods	Severe sites remain wet for long periods.
*Waymor WmB	Moderate where slopes are 2 to 6 percent	Slight where slopes are 2 to 6 percent; erodible on slopes; stony in places	Slight	Slight	Slight
WoA, WoB, WoC2, WoD2, WsC, WsE For Casco and Sisson parts of mapping units WsC and WsE see respective series.	Moderate where slopes are 0 to 6 percent; severe on steeper soils; compacts easily; muddy and slippery when wet; erodible; stony in places	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent; severe on steeper soils; erodible; stony in places	Moderate where slopes are 0 to 12 percent, severe on steeper soils; muddy and slippery when wet; erodible	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent, severe on steeper soils; erodible; stony in places	Moderate where slopes are 0 to 12 percent; severe on steeper soils; sites remain wet and soft for short periods; erodible; stony in places
Yahara YaA, YhA	Moderate seasonal high water table; sod easily damaged when wet	Moderate seasonal high water table, water ponds for short periods in some low areas	Moderate wet for moderate periods; erodible and poor stability; difficult to maintain.	Moderate seasonal high water table; sites remain wet and soft for moderate periods; turf easily damaged when wet.	Moderate sites remain wet and soft for moderate periods; erodible.

Engineering Uses of the Soils [3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slopes and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soils.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or on similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicle and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 8, 9, 10, and 11, which show results of engineering laboratory tests on soil samples, several estimated soil properties significant to engineering, and interpretations for various engineering uses. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 10 and 11. It also can be used to make other useful maps.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and in places where the excavations are deeper than the depths of layers here reported. Estimates generally are made to a depth of about 5 feet and interpretations do not apply to greater depths. Also, engineers should not apply specific values to the estimates for bearing capacity and traffic-supporting capacity given in this survey. Investigation of each site is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some of the terms used in this survey have special meaning to soil scientists but are not known to all engineers. Many of the terms commonly used in soil science are defined in the Glossary at the back of this survey.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*9*), used by SCS engineers, the Department of Defense, and others, and the AASHO system (*1*), adopted by the American Association of State Highway Officials.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 8; the estimated classification, without group index numbers, is given in table 9 for all soils mapped in the survey area.

Engineering test data

To help evaluate the soils for engineering purposes, soil samples from major horizons of some representative profiles were tested. Table 8 contains the engineering test data for several of the common soils in Brown County. As indicated in the table, tests were made by several agencies concerned with soil data.

The tests to show liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a semisolid to a plastic state. The

[3] By EMERON P. CHRISTENSEN, civil engineer, Soil Conservation Service.

liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

The table also gives optimum moisture and maximum dry density values for most of the tested soils. If soil material is compacted at successively higher moisture contents, assuming that the compactive effort remains constant, the density of the compacted material will increase until the *optimum moisture content* is reached. After that the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed maximum dry density. Moisture-density data are important in earthwork, for, as a general rule, highest stability is obtained if the soil is compacted to maximum dry density when at optimum moisture content.

Engineering properties of soils

Classification of the soils and properties significant to engineering are given in table 9. The information is based on test data in table 8 and on tests on similar soils in other counties. If no test results were available, estimates were made by comparison with soils of like material previously tested and by making observations and determinations in the field.

The estimates in table 9 are for soils as they occur in their natural state and not for disturbed areas that have been altered by cut and fill operations. The soil names are listed alphabetically. Other information about the properties of the soils can be obtained by referring to the section "Descriptions of the Soils."

Under the heading "Classification," the respective USDA, Unified, and AASHO classifications are given. The estimated percentage of material passing through the various sieves for each of the major soil horizons has been rounded off to the nearest 5 percent. The range of values is generally within 5 percent of the value given.

In the column showing permeability, the rate at which water moves through a saturated soil horizon is estimated. The ratings are given in inches per hour. Texture, structure, and consistence of the soil are the principal factors

TABLE 8.—*Engineering*

[Except as indicated, tests were performed by State Highway Commission of Wisconsin in cooperation with the U S. Department of (*1*). Dashes in columns mean information

Soil name and location of sample	Parent material	Depth from surface	Moisture density data [1]	
			Maximum dry density	Optimum moisture
		In	*Lbs /cu ft*	*Pct*
Briggsville silt loam NE¼NW¼ sec 19, T. 24 N., R 20 E. (modal)	Silt and clay lake sediment.	13–22 26–42	97. 2 106. 2	24. 2 19. 8
Kewaunee silt loam SE¼NW¼ sec. 22, T 23 N., R. 21 E (slightly coarser texture than modal).	Clayey drift	11–20 48–54	--- ---	--- ---
Kewaunee silt loam: [4] SW¼ sec. 21, T 22 N , R 21 E. (modal)	Clayey drift.	48–54	---	---
Kolberg silt loam [5] NE¼SE¼ sec 7, T 24 N , R 22 E (modal)	Clayey drift over bedrock.	16–23 30–33	--- ---	--- ---
Onaway loam SW¼NW¼ sec. 3, T 24 N., R 19 E. (modal)	Loamy drift.	14–18 23–48	111. 2 133. 1	15. 0 8. 3
Oshkosh silty clay loam [4] SW¼ sec 33, T 23 N , R. 20 E (modal)	Clayey lake sediment	48–54	---	---
Poygan silty clay loam NW¼NW¼ sec. 20, T. 21 N , R. 20 E (modal)	Clayey lake sediment.	12–17 24–45	97. 1 98 1	24. 8 24. 1
Waymor silt loam SW¼SW¼ sec. 17, T. 24 N., R 20 E (modal)	Loamy drift	19–25 28–48	102. 7 118. 9	21. 4 13. 0

[1] Based on AASHO Designation T99–57, Method A (*1*).

[2] According to AASHO Designation T88–57 (*1*) Results obtained by this procedure may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for naming textural classes of soils.

that affect soil permeability. The permability rate of a soil is generally determined by the least permeable layer in the soil.

Permeability classes by inches per hour are as follows: Very slow, less than 0.06 of an inch per hour; slow, 0.06 to 0.20 inch per hour; moderately slow, 0.20 to 0.63 inch per hour; moderate, 0.63 to 2.0 inches per hour; moderately rapid, 2.0 to 6.3 inches per hour; and rapid, more than 6.3 inches per hour.

The estimated available water capacity in inches per inch of soil is given for the major soil horizons. Available water capacity refers to the amount of water that can be stored in the soil for plant use.

The column showing reaction indicates the estimated acidity or alkalinity of the soils expressed in terms of pH. A neutral soil has a pH of 7. A pH value lower than 7 indicates acidity, and a pH value higher than 7 indicates alkalinity. A knowledge of the pH of soil horizons can be used to indicate the need for liming and for determining the hazard of corrosion for metal conduits and the risk of deterioration for concrete tile.

Shrink-swell potential refers to the change in volume of the soil material that results from a change in moisture content. It is based on volume-change tests or on observance of other physical properties of the soils. The amount and kind of clay and the content of organic matter in the soils affect shrink-swell behavior. Soils in which illite clays are dominant, for example, do not have so high a shrink-swell ratio as soils in which montmorillonite clays are dominant.

The corrosion potential of soils for underground metal pipes and concrete conduits is closely related to soil reaction, drainage, and electrical conductivity of the soil solution. Most conduits are laid in the lower soil or underlying material. Generally, poor aeration and high pH values, high electrical conductivity, and high moisture content are characteristic of soils that are corrosive to metal conduits. Soils that have low pH values are the most corrosive for concrete conduits. In both cases corrosion is more rapid when the moisture content of the soil is high. The ratings given are *low*, *medium*, and *high* and are based on relative corrosiveness.

test data

Commerce, Bureau of Public Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO) was not available or does not apply]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—			Percentage smaller than—						AASHO	Unified [3]
No. 10 (2.0 mm)	No. 40 (0.42 mm.)	No 200 (0 074 mm)	0.05 mm	0.02 mm.	0.005 mm	0.002 mm.				
100	100	99	99 0	96	78	55 0	53 7	29 1	A–7–6(19)	CH
100	98	97	97 0	95	65	37 0	33. 1	13 3	A–6(9)	CL
100	97	68	66 0	60	46	35 0	41 4	25 0	A–7–6(13)	CL
100	96	73	71 0	60	44	30 0	31. 2	16 8	A–6(11)	CL
100			86 0			45 5				
100			64. 6			35 5				
100			46 0			8 7				
97	94	65	61. 0	48	33	26 0	35 4	18 3	A–6(9)	CL
87	81	40	37. 0	26	16	10 0	15 8	2 0	A–4(1)	SM
100			98 0			66 0				
100	100	99	97 0	92	73	58 0	56. 8	33 4	A–7–6(19)	CH
100	100	99	99 0	97	86	71 0	45 5	26 3	A–7–6(16)	CH
100	98	87	85 0	77	49	35. 0	42 4	21 5	A–7–6(13)	CL
91	87	78	76. 0	64	31	17 0	25 4	8 1	A–4(8)	ML

[3] Based on Unified soil classification system (*9*) SCS and BPR have agreed that a soil having a plasticity index within 2 points of A-line is to be given a borderline classification.

[4] Data from samples collected and analyzed by Soils Department and Soil Survey Division, Wisconsin Geological and Natural History Survey, University of Wisconsin Particle-size distribution of <2 millimeter fraction by Paul Day hydrometer method

[5] Data from soil analysis (1969) by Soil Survey Laboratory, Soil Conservation Service, Lincoln, Nebr. Particle-size distribution analysis by pipette method

TABLE 9.—*Estimated soil properties*

[Not included in this table, because their properties are too variable to estimate, are the land types Alluvial land, (Au); Alluvial land, wet, Stony and rocky land, (Sr). An asterisk in the first column indicates that at least one mapping unit in this series is made up of two follow carefully the instructions for referring to other series that appear in the first column of this table. The symbol > means greater

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Water table		USDA texture	Unified	AASHO
	In	*Ft*	*In*			
Allendale AdA, AeA	60+	[2] 1–3	0–8	Loamy fine sand	SM	A–2
			8–26	Fine sand	SP–SM	A–3
			26–60	Silty clay	CH	A–7
Angelica· Ax	60+	0–1	0–8	Silt loam	ML	A–4
			8–27	Loam	CL	A–6
			27–60	Loam	ML	A–4
Bellevue· Bc	60+	3–5	0–18	Silt loam	ML or CL	A–4
			18–46	Loam	ML or CL	A–4
			46–60	Silty clay loam	CL	A–7
Bellevue, mottled subsoil variant Bd	60+	1–3	0–12	Silty clay loam	CL	A–7
			12–27	Silty clay loam	CH	A–7
			27–60	Silty clay loam	CH	A–7
Bonduel: BnA	20–40	1–3	0–16	Loam	ML	A–4
			16–24	Sandy clay loam	SC	A–6
			24–30	Loam	ML	A–4
			30–60	Bedrock.		
Boyer BrB, BrC2, BrD2, BrE	60+	5+	0–18	Loamy fine sand	SM	A–2
			18–35	Fine sandy loam	SM	A–4
			35–60	Fine to medium sand	SP–SM	A–3
Briggsville. BtB	60+	5+	0–7	Silt loam	CL or ML	A–4
			7–26	Silty clay	CH	A–7
			26–60	Silty clay loam	CL	A–6 or A–7
Carbondale· Ca	60+	0–1	0–32	Muck	Pt	
			32–45	Mucky peat	Pt	
			45–60	Muck	Pt	
*Casco CcB, CcC2, CdE2	60+	5+	0–9	Loam	ML	A–4
For Rodman part of CdE2, see Rodman series			9–19	Sandy clay loam	SC	A–6
			19–60	Sand and gravel	GP–GM	A–1
Cathro· Cm	60+	0–1	0–14	Muck	Pt	
			14–26	Mucky peat	Pt	
			26–60	Loam	ML	A–4
Dresden· DdA, DrA	60+	5+	0–14	Silt loam	CL or ML	A–4
			14–28	Sandy clay loam	SC	A–6
			28–60	Sand and gravel	GP–GM	A–1
Dresden, mottled subsoil variant DeA, DsA.	60+	1–3	0–9	Silt loam	CL or ML	A–4
			9–31	Sandy clay loam	SC	A–6
			31–60	Sand and gravel	GP–GM	A–1
Fabius Fa	60+	1–3	0–7	Silt loam	CL or ML	A–4
			7–18	Sandy clay loam	SC	A–6
			18–60	Sand and gravel	GM–GW	A–1
Hochheim HoB, HoC2	60+	5+	0–7	Loam	CL or ML	A–4
			7–19	Sandy clay loam	SC	A–6
			19–60	Sandy loam	SM	A–2
Keowns: Ke	60+	0–1	0–6	Silt loam	ML	A–4
			6–21	Silt loam	ML	A–4
			21–60	Stratified silt and fine sand	ML	A–4

See footnotes at end of table.

significant to engineering

(Aw); Borrow pits, (Bp); Dumps, (Du); Fill land, (Fd); Gravel pits, (Gp), Marsh, (Mr); Quarries, (Qu); Rough broken land, (Ro); and or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to than and the symbol < means less than]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential for conduits [1]	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No 200 (0.07 mm.)					Metal	Concrete
			In /hr	*In /in of soil*	*pH*			
100	95–100	20–30	6. 3–20. 0	0 08–0. 10	6. 0–7. 0	Low.		
100	95–100	5–10	6. 3–20. 0	0 06–0 08	6. 0–7. 0	Low	Low	Low.
100	95–100	90–95	0. 06–0. 2	0 14–0. 18	7. 0–8. 0	High	Moderate	Low.
90–100	80–90	70–90	0. 63–2. 0	0. 18–0 22	6 0–7. 3	Low		
90–100	80–95	60–75	0 63–2. 0	0 16–0. 20	6. 0–7. 3	Moderate	Low	Low.
80–90	75–85	55–75	0 63–2 0	0. 16–0. 20	(3)	Low	Low	Low.
	95–100	70–90	0 63–2 0	0 18–0 22	7. 4–7 8	Low.		
	95–100	60–75	0 63–2 0	0. 16–0 20	7. 4–7. 8	Low	Low	Low.
	95–100	85–95	0. 20–0. 63	0. 16–0. 20	7. 4–7. 8	Moderate	Low	Low.
	90–100	85–95	0. 20–0. 63	0 16–0 20	6 6–7. 3	Moderate.		
	90–100	85–95	0. 20–0 63	0. 16–0 20	6. 6–7. 3	High	High	Low.
	90–100	85–95	0. 20–0 63	0 16–0. 20	7. 0–8. 0	High	High	Low.
85–95	80–90	60–75	0 63–2 0	0. 16–0 20	7. 4–7. 8	Low.		
85–95	85–95	35–50	0. 63–2. 0	0. 14–0. 18	6. 5–7. 3	Moderate	High	Low.
85–95	80–90	60–75	0. 63–2. 0	0. 16–0. 20	7. 4–7. 8	Low	High	Low.
90–100	80–90	20–30	6 3–20. 0	0 08–0. 10	5. 0–6. 5	Low.		
80–90	70–85	40–50	2 0–6. 3	0. 10–0 14	5 6–7. 0	Low	Low	Low
90–100	80–90	5–10	6. 3–20. 0	0 05–0. 08	7. 4–8. 5	Low	Low	Low.
	95–100	70–90	0. 63–2. 0	0. 18–0 22	5. 6–6 5	Low.		
	95–100	85–95	0. 20–0. 63	0. 14–0 18	5. 0–6. 5	High	Moderate	Low.
	95–100	85–95	0. 20–0. 63	0. 16–0. 20	7. 4–8. 5	Moderate	Moderate	Low.
			2. 0–6. 3	0. 25–0. 35	5 5–7. 5		High	Low.
			2 0–6. 3	0. 25–0 35	5. 5–7. 5		High	Low
			2 0–6. 3	0. 25–0. 35	5. 5–7. 5		High	Low.
90–100	80–90	60–75	0. 63–2. 0	0. 16–0. 20	6 6–7. 8	Low.		
90–100	85–95	35–50	0 63–2. 0	0. 14–0. 18	6. 6–7. 8	Moderate	Low	Low.
30–40	25–35	5–10	6 3–20+	0 02–0. 04	7. 4–8. 5	Low	Low	Low.
			2. 0–6. 3	0. 25–0. 35	6 1–7. 8		Moderate	Low
			2. 0–6. 3	0. 25–0 35	6. 1–7 8		Moderate	Low.
90–100	80–90	60–75	0. 63–2. 0	0. 16–0 20	6. 1–7. 3	Low	Moderate	Low.
95–100	90–100	70–90	0. 63–2 0	0. 18–0 22	7. 4–7. 8	Low.		
95–100	90–100	35–55	0. 63–2. 0	0. 14–0. 18	7. 4–7. 8	Moderate	Low	Low.
40–50	30–40	5–10	6. 3–20+	0 02–0. 04	7. 4–8. 4	Low	Low	Low.
95–100	90–100	70–90	0 63–2. 0	0. 18–0. 22	7. 4–7 8	Low.		
95–100	90–100	35–55	0. 63–2. 0	0. 14–0. 18	7 4–7. 8	Moderate	Moderate	Low.
40–50	30–40	5–10	6. 3–20+	0. 02–0. 04	7. 4–8. 4	Low	Moderate	Low.
	95–100	70–90	0 63–2 0	0 18–0 22	7. 4–7. 8	Low.		
	95–100	35–50	0 63–2 0	0. 14–0. 18	7. 4–7. 8	Moderate	Moderate	Low.
40–50	20–30	5–10	6 3–20+	0. 02–0 04	7. 4–8 4	Low	High	Low.
90–100	85–95	60–75	0 63–2 0	0 16–0. 20	7. 4–7 8	Low.		
90–100	85–95	35–50	0 63–2. 0	0. 14–0 18	7. 4–7. 8	Moderate	Moderate	Low
80–90	70–80	25–35	2. 0–6 3	0 08–0. 12	7. 9–8 4	Low	Moderate	Low.
	95–100	70–90	0 63–2. 0	0. 18–0 22	7. 4–7 8	Low.		
	95–100	70–90	0 63–2 0	0. 18–0. 22	7 4–8. 4	Low	High	Low
	95–100	75–85	0. 63–2 0	0. 06–0. 12	7. 4–8. 4	Low	High	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		AASHO
	Bedrock	Water table		USDA texture	Unified	
	In	*Ft*	*In*			
*Kewaunee KfB, KfC2, KgB, KhB, KhB2, KhC2, KhD2, KhE2, KkC3, KkD3, KkE3, KlB, KlB2, KmE2 For properties of Manawa soil in mapping units KlB and KlB2, and for properties of Sisson soil in mapping unit KmE2, see respective series.	60+	5+	0–8	Silt loam	CL or ML	A–4
			8–27	Silty clay	CH	A–7
			27–60	Clay loam	CL	A–7
Kibbie KnA	60+	[2] 1–3	0–10	Silt loam	CL or ML	A–4
			10–26	Silty clay loam	CL	A–7
			26–60	Stratified silt and fine sand	ML	A–4
Kolberg KoB, KoC2	20–40	5+	0–16	Silt loam	ML	A–4
			16–30	Silty clay loam	CH	A–7
			30–33	Loam	ML	A–6
			33–60	Bedrock.		
Lamartine. LaA	60+	[2] 1–3	0–22	Silt loam	CL or ML	A–4
			22–38	Silty clay loam	CL	A–6
			38–60	Loam	ML	A–4
Manawa MaA, McA	60+	[2] 1–3	0–8	Silty clay loam	CL	A–6
			8–30	Silty clay	CH	A–7
			30–60	Heavy clay loam	CL	A–6
Manistee MeB, MeC2, MfB	60+	5+	0–11	Loamy fine sand	SM	A–2
			11–27	Fine and medium sand	SP–SM	A–3
			27–60	Silty clay	CH	A–7
Markey. Mk	60+	0–1	0–35	Muck	Pt	----------
			35–60	Sand	SP–SM	A–3
Menominee MsB	60+	5+	0–22	Loamy fine sand	SM	A–2
			22–35	Loam	CL	A–4
			35–60	Sandy loam	SM	A–2
Namur NaB, NaD	0–12	5+	0–6	Silt loam	ML	A–4
			6–60	Bedrock.		
Namur, wet variant. Ne	0–12	0–1	0–8	Silt loam	ML	A–4
			8–10	Fine sandy loam	SM	A–4
			10–60	Bedrock.		
Ogden· Od	60+	0–1	0–17	Muck	Pt	----------
			17–32	Mucky peat	Pt	----------
			32–60	Silty clay	CH	A–7
*Onaway OeB, OeC2, OhA, OhB, OhD2, OlB For properties of Solona soil in mapping unit OlB, refer to Solona series.	60+	5+	0–13	Fine sandy loam	SM	A–2
			13–27	Clay loam	CL	A–6
			27–60	Sandy loam	SM	A–2 or A–4
Oshkosh OmA, OmB, OnA, OnB, OnC2, OnD2, OnE2, OoB, OsA, OsB	60+	3–5	0–7	Silt loam	ML or CL	A–4 or A–6
			7–29	Silty clay	CH	A–7
			29–60	Silty clay	CH	A–7
Pella Pe	60+	0–1	0–19	Silt loam	ML or CL	A–4
			19–38	Silty clay loam	CL	A–6
			38–60	Loam	ML	A–4
Poygan: Po	60+	0–1	0–7	Silty clay loam	CL	A–6
			7–24	Clay	CH	A–7
			24–60	Clay	CH	A–7

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential for conduits [1]	
No. 4 (4.7 mm.)	No. 10 (2.0 mm)	No. 200 (0.07 mm)					Metal	Concrete
			In /hr	*In /in of soil*	*pH*			
	90–100	70–90	0 63–2 0	0 18–0 22	6 1–7 3	Low.		
	90–100	90–95	0 06–0 2	0 14–0 18	6 1–7 8	High	Moderate	Low.
90–100	85–95	70–80	0 20–0 63	0 16–0 20	7 4–8. 4	Moderate	Moderate	Low.
	90–100	70–90	0 63–2 0	0 18–0 22	6. 6–7. 3	Low.		
	90–100	85–95	0 63–2 0	0 16–0 20	6 6–7. 8	Moderate	High	Low.
	90–100	75–85	0. 20–0. 63	0 06–0 12	7. 4–8. 4	Low	High	Low.
	90–100	70–90	0 63–2 0	0 18–0 22	6 6–7 3	Low.		
	90–100	85–95	0 20–0. 63	0 16–0 20	6 6–7 3	Moderate	Moderate	Low.
	80–90	60–75	0 63–2. 0	0 16–0 20	7 4–7. 8	Low	Moderate	Low.
	90–100	70–90	0 63–2 0	0. 18–0 22	7. 4–7. 8	Low.		
	90–100	85–95	0 63–2 0	0. 16–0 20	7 4–7. 8	Moderate	High	Low.
90–100	80–90	60–75	0 20–0 63	0 16–0 20	7 9–8. 4	Low	High	Low.
90–100	90–100	85–95	0 20–0 63	0 16–0 20	6 6–7 8	Moderate.		
90–100	90–100	90–95	0 06–0 2	0. 14–0 18	6 6–7 8	High	High	Low.
85–95	85–90	70–80	0 06–0 2	0 16–0 20	7 4–8 4	Moderate	High	Low.
	80–90	20–30	6 3–20 0	0 08–0 10	6 1–6. 5	Low.		
	90–100	5–10	6 3–20 0	0 05–0 08	6 1–7. 3	Low	Moderate	Low.
	90–100	80–95	0 06–0 20	0. 14–0 18	7 4–8 4	High	Moderate	Low.
			2 0–6 3	0 25–0 35	7 4–7. 8			
90–100	70–90	5–10	6 3–20 0	0 05–0 07	7. 4–7. 8	Low	Moderate	Moderate.
	90–100	20–30	6. 3–20 0	0 08–0 10	6. 1–7. 3	Low.		
	90–100	60–75	0 63–2 0	0. 16–0. 20	6 1–7 3	Low	Moderate	Low.
	90–100	25–35	2 0–6. 3	0. 08–0 12	7 4–8 4	Low	Moderate	Low.
90–100	90–100	70–90	0 63–2 0	0 18–0 22	7. 4–8. 4	Low.		
90–100	90–100	70–90	0 63–2 0	0 18–0 22	7. 4–8. 4	Low.		
90–100	90–100	35–45	2 0–6 3	0 10–0 14	7. 9–8 4	Low	High	Low.
			2. 0–6 3	0. 25–0 35	6. 6–7 3			
			2 0–6 3	0 25–0 35	6. 6–7. 3		Moderate	Low.
	90–100	90–95	0 06–0 2	0 14–0. 18	7. 4–8 4	High	High	Low.
90–100	85–95	25–35	2 0–6 3	0 10–0 14	6 1–7. 8	Low.		
90–100	85–95	70–80	0 63–2 0	0 16–0 20	6 6–8 4	Moderate	Moderate	Low.
80–90	85–95	25–40	0 63–2 0	0 16–0 20	7. 9–9 0	Low	Moderate	Low.
	95–100	70–90	0 63–2 0	0 21–0 23	6 1–7 3	Low to moderate.		
	95–100	90–95	0 06–0 2	0 11–0 13	5 6–7 3	High	Moderate	Low.
	95–100	90–95	0 06–0. 2	0 10–0 12	7 4–8 4	High	Moderate	Low.
95–100	90–100	70–90	0 63–2 0	0 18–0 22	7 4–8 4	Low.		
	95–100	85–95	0 20–0 63	0 16–0 20	7 4–8 4	Moderate	High	Low.
	95–100	60–75	0 63–2 0	0 16–0 20	7 9–8. 4	Low	High	Low.
	90–100	85–95	0 2–0 63	0 16–0 20	6 1–7 3	Moderate		
	90–100	75–95	<0 06	0 10–0 14	6 6–7 8	High	High	Low.
	90–100	75–95	<0 06	0. 10–0 14	7 4–8 4	High	High	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Water table		USDA texture	Unified	AASHO
	In	*Ft*	*In*			
Rodman	60+	5+	0–8	Loam	ML	A–4
Mapped only in a complex with Casco soils.			8–60	Sand, gravel and cobblestones	GP or GW	A–1
Roscommon Rs	60+	0–1	0–3	Loamy fine sand	SM	A–2
			3–60	Fine and medium sand	SP–SM	A–3
Ruse Ru	10–20	0–1	0–3	Silt loam	ML	A–4
			3–19	Loam	ML	A–4
			19–60	Bedrock.		
Sebewa Sb	60+	0–1	0–12	Silt loam	ML	A–4
			12–29	Silty clay loam	CL	A–6
			29–60	Sand and gravel	GP–GM	A–1
Shawano SeC, SeD, SfB, SfC	60+	5+	0–10	Loamy fine sand	SM	A–2
			10–60	Fine and medium sand	SP–SM	A–3
Shullsburg, wet variant SgB	20–40	1–3	0–8	Silt loam	ML	A–4 or A–6
			8–23	Silty clay	CH	A–7
			23–60	Bedrock.		
Sisson ShB, ShC2, ShD2, SnA, SnB	60+	5+	0–11	Silty loam	ML	A–4
			11–25	Silty clay loam	CL	A–6
			25–60	Stratified silt and fine sand	ML	A–4
Solona SoA, SpA	60+	1–3	0–15	Loam	ML	A–4
			15–26	Clay loam	CL	A–6
			26–60	Loam	ML	A–4
Summerville. SuB, SuD2	10–20	5+	0–7	Loam	ML	A–4
			7–14	Loam	ML	A–4
			14–60	Bedrock.		
Summerville, clayey subsoil variant SvB.	10–20	5+	0–8	Silt loam	ML	A–4
			8–18	Clay loam	CL	A–6
			18–60	Bedrock.		
Tedrow. TeA	60+	1–3	0–7	Loamy fine sand	SM	A–2
			7–60	Fine sand	SP–SM	A–3
Wauseon Wa	60+	0–1	0–13	Fine sandy loam	SM	A–4
			13–24	Loamy sand	SM	A–2
			24–60	Silty clay loam	CL	A–6
*Waymor. WmB, WoA, WoB, WoC2, WoD2, WsC, WsE	60+	5+	0–16	Silt loam	ML	A–4
For properties of Casco and Sisson soils in mapping units WsC and WsE, see the Casco and Sisson series.			16–34	Clay loam	CL	A–6 or A–7
			34–60	Loam	ML	A–4
Yahara YaA, YhA	60+	1–3	0–7	Silt loam	ML	A–4
			7–15	Fine sandy loam	SM	A–4
			15–60	Stratified silt and fine sand	ML	A–4

[1] Corrosion potential is estimated only for the horizons in which conduits are likely to be buried.
[2] Perched water table is caused by moderately slowly or slowly permeable substratum.

significant to engineering—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential for conduits [1]	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.07 mm.)					Metal	Concrete
			In /hr	*In /in of soil*	*pH*			
70–80	70–80	50–75	0.63–2.0	0.16–0.20	7.4–7.8	Low.		
40–50	30–40	0–5	>20	0.02–0.04	7.4–8.4	Low	Low	Low.
95–100	95–100	15–25	6.3–20.0	0.08–0.10	6.6–7.3	Low.		
95–100	85–95	5–10	6.3–20.0	0.05–0.08	6.1–7.3	Low	Moderate	Low.
90–100	90–100	70–90	0.63–2.0	0.18–0.22	6.6–7.3	Low.		
90–100	90–100	60–75	0.63–2.0	0.16–0.20	6.6–7.8	Moderate	High	Low.
90–100	90–100	70–90	0.63–2.0	0.18–0.22	6.6–7.8	Low.		
90–100	85–95	80–90	0.63–2.0	0.16–0.20	6.6–7.8	Moderate	High	Low.
35–45	30–40	5–10	6.3–20.0	0.02–0.04	7.4–8.4	Low	High	Low.
	90–100	20–30	6.3–20.0	0.08–0.10	5.6–7.3	Low.		
	90–100	5–10	6.3–20.0	0.05–0.08	5.6–7.3	Low	Low	Low.
	95–100	70–90	0.63–2.0	0.18–0.22	7.4–8.4	Low.		
	95–100	90–95	0.06–0.2	0.14–0.18	7.4–8.4	High	Moderate	Low.
	95–100	70–90	0.63–2.0	0.18–0.22	6.6–7.8	Low.		
	90–100	85–95	0.63–2.0	0.16–0.20	6.6–7.8	Moderate	Moderate	Low.
	95–100	75–85	0.63–2.0	0.06–0.12	7.4–8.4	Low	Moderate	Low.
90–100	85–95	60–75	0.63–2.0	0.16–0.20	7.4–8.4	Low.		
90–100	85–95	70–80	0.63–2.0	0.16–0.20	7.4–8.4	Moderate	High	Low.
80–90	70–80	60–75	0.63–2.0	0.16–0.20	7.4–8.4	Low	High	Low.
90–100	85–95	60–75	0.63–2.0	0.16–0.20	7.4–7.8	Low.		
90–100	80–90	60–75	0.63–2.0	0.16–0.20	7.4–7.8	Low	Moderate	Low.
95–100	90–100	70–90	0.63–2.0	0.18–0.22	7.4–7.8	Low.		
95–100	90–100	70–80	0.20–0.63	0.16–0.20	7.4–8.4	Moderate	Moderate	Low.
95–100	85–95	20–30	6.3–20.0	0.08–0.10	6.1–7.3	Low.		
95–100	85–95	5–10	6.3–20.0	0.06–0.08	6.6–7.3	Low	Low	Low.
90–100	80–90	35–45	2.0–6.3	0.10–0.14	6.6–7.3	Low.		
90–100	80–90	20–30	6.3–20.0	0.07–0.09	6.6–7.3	Low	Moderate	Low.
90–100	85–95	85–95	0.06–0.2	0.16–0.20	6.6–8.4	Moderate	High	Low.
95–100	90–100	70–90	0.63–6.3	0.18–0.22	6.6–7.8	Low		
	90–100	70–80	0.63–2.0	0.16–0.20	7.4–8.4	Moderate	Moderate	Low.
85–95	85–95	60–75	0.63–2.0	0.16–0.20	7.4–8.4	Low	Moderate	Low
	90–100	70–90	0.63–2.0	0.18–0.22	7.4–7.8	Low.		
	85–95	35–45	0.63–2.0	0.10–0.14	7.4–8.4	Low	Moderate	Low
	85–95	75–85	0.63–2.0	0.06–0.12	7.4–8.4	Low	Moderate	Low

[3] Calcareous

TABLE 10.—*Engineering interpretations*

[Not included in this table, because their properties are too variable to estimate and onsite investigation generally is required, are the land column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units series that appear in the first column of this table]

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road subgrade and highway fill
Allendale· AdA	Poor sandy, droughty, erodible	Poor poorly graded sand with fines in subsoil, substratum clayey	Subsoil good; substratum poor; high shrink-swell potential, low bearing capacity
AeA	Surface layer fair, sandy, subsoil poor, sandy.	Poor poorly graded sand with fines in subsoil, substratum clayey	Subsoil good; substratum poor; high shrink-swell potential; low bearing capacity
Alluvial land. Au	Fair	Unsuitable· loamy	Poor: subject to occasional flooding, frost hazard.
Aw	Fair. high water table, subject to flooding	Unsuitable loamy	Poor low bearing capacity unstable and not accessible when wet.
Angelica Ax	Surface layer good, subsoil poor, gravelly, high water table	Poor· pockets of poorly graded sand and gravel occur in places in substratum	Poor. low bearing capacity; unstable and not accessible when wet
Bellevue Bc	Surface layer good, subsoil and substratum poor; clayey	Unsuitable clayey	Fair low bearing capacity, susceptible to frost heave; subject to overflow
Bellevue, mottled subsoil variant· Bd.	Surface layer good, thin, subsoil poor, clayey.	Unsuitable clayey	Subsoil good, substratum fair, high shrink-swell potential, low bearing capacity subject to flooding.
Bonduel BnA	Surface layer good, subsoil fair, low fertility, gravelly in places	Unsuitable loam material over limestone	Subsoil fair; moderate stability and bearing capacity.
Boyer BrB, BrC2, BrD2, BrE	Surface layer fair, droughty, subsoil poor, sand, droughty, erodible	Good poorly graded to well-graded sand containing pockets of gravel in substratum.	Good
Briggsville BtB	Surface layer good, subsoil fair, clayey	Unsuitable· clayey	Poor. moderate or high shrink-swell potential, low bearing capacity and unstable when wet, high compressibility and elasticity.

for town and country planning

types Borrow pits, Bp, Dumps, Du, Fill land, Fd, Gravel pits, Gp, Quarries, Qu; and Rough broken land, Ro. An asterisk in the first may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other

Degree and kind of limitations for—				
Highway and street location	Foundations for low buildings	Sanitary landfill	Sewage lagoons	Disposal fields
Moderate: seasonal perched water table 1 to 3 feet below surface, low stability	Moderate· high shrink-swell potential, low bearing capacity, seasonal perched water table.	Severe clayey substratum, seasonal high water table.	Moderate seasonal perched water table.	Severe seasonal perched water table.
Moderate seasonal perched water table at a depth of 1 to 3 feet, low stability.	Moderate high shrink-swell potential, low bearing capacity, seasonal perched water table.	Severe clay substratum, seasonal high water table	Moderate. seasonal perched water table.	Severe. seasonal perched water table.
Severe subject to occasional flooding, high frost-heave potential	Severe· moderate compressibility and bearing capacity, very severe for basements, occasional flooding.	Severe: subject to flooding.	Severe· subject to flooding, moderate permeability.	Very severe: subject to flooding.
Severe high water table, hauling and excavating difficult	Very severe frequent flooding, high water table, low stability.	Very severe high water table, frequent flooding.	Very severe. frequent flooding.	Very severe high water table, frequent flooding.
Severe less than 1 foot to permanent or seasonal water table, hauling and excavating difficult.	Severe high water table hinders installation, very severe for basements, subject to wetness, low bearing capacity.	Severe. high water table	Very severe: high water table, moderate permeability.	Very severe· high water table
Severe subject to flooding, susceptible to frost heave.	Severe· moderate shrink-swell potential, low bearing capacity, subject to flooding.	Severe· subject to flooding	Severe: subject to flooding.	Severe subject to flooding.
Severe. subject to flooding, moderate frost heave potential, highly plastic.	Severe· high shrink-swell potential, low bearing capacity, moderate shear strength, very severe for basements, subject to flooding.	Severe: subject to flooding.	Severe subject to flooding.	Severe· subject to flooding.
Moderate. seasonal water table at a depth of 1 to 3 feet; depth to limestone is 2 to 4 feet	Moderate. high water table restricts installation, basement subject to wetness, severe where limestone must be excavated	Severe: seasonal high water table, difficult to work in wet seasons danger of contaminating ground water.	Severe less than 40 inches to limestone bedrock, seasonal high water table.	Severe: seasonal high water table, danger of ground water contamination
Moderate· loose sand hinders hauling in places, subject to soil blowing.	Slight	Severe little amelioration of leachate.	Severe· rapid permeability in substratum	Moderate where slopes are 2 to 12 percent; severe on steeper soils, danger of ground water contamination.
Severe· low stability in fills.	Moderate: low bearing capacity; moderate shrink-swell potential; moderate shear strength.	Moderate: clayey substratum ponds water, difficult to work in wet season.	Moderate· moderately slow permeability.	Severe: moderately slow permeability.

TABLE 10.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road subgrade and highway fill
Carbondale: Ca	Poor: erodible; oxidizes rapidly	Unsuitable: organic soil	Unsuitable: organic soil; high compressibility; unstable.
*Casco: CcB, CcC2, CdE2. For Rodman part of CdE2, see Rodman series	Surface layer good; subsoil fair; clayey; thin over gravel.	Good: poorly graded to well-graded sand and gravel in substratum.	Subsoil fair; moderate shrink-swell potential; substratum good.
Cathro. Cm	Poor: surface layer and subsoil are erodible and oxidize rapidly.	Unsuitable: organic soil over loam.	Unsuitable: unstable; high compressibility; very low bearing capacity.
Dresden: DdA	Surface layer fair; sandy; subsoil fair; clayey; gravelly in places.	Good: poorly graded to well-graded sand and gravel in substratum.	Subsoil fair; moderate shrink-swell potential; moderate bearing capacity when wet; substratum good; highly stable.
DrA	Surface layer good; subsoil fair; clayey; gravelly in places.	Good: poorly graded to well-graded sand and gravel in substratum.	Subsoil fair; moderate shrink-swell potential; moderate bearing capacity when wet; substratum good; highly stable.
Dresden, mottled subsoil variant: DeA	Surface layer fair, subsoil fair, clayey, thin over sand and gravel.	Good: poorly graded to well-graded sand and gravel in substratum.	Subsoil fair; moderate shrink-swell potential and bearing capacity, substratum good; highly stable.
DsA	Surface layer good; subsoil fair; clayey, thin over sand and gravel.	Good: poorly graded to well-graded sand and gravel in substratum.	Subsoil fair; moderate shrink-swell potential and bearing capacity; substratum good; highly stable.
Fabius Fa	Surface layer good, thin, subsoil fair, thin, medium fertility.	Good: substratum is poorly graded sand and gravel.	Subsoil fair; low compressibility; substratum good, very low compressibility, poor stability unless confined; high bearing capacity.
Hochheim HoB, HoC2	Surface layer good, thin, subsoil fair, clayey, thin, stony in places	Poor. pockets of poorly graded sand and gravel in substratum in places.	Subsoil fair, moderate shrink-swell potential; moderate bearing capacity; unstable when wet, substratum good.
Keowns Ke	Surface layer good, thin, subsoil poor, unstable on slopes, high water table	Unsuitable	Poor. unstable when wet; highly susceptible to frost heave, high water table.

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Degree and kind of limitations for—				
Highway and street location	Foundations for low buildings	Sanitary landfill	Sewage lagoons	Disposal fields
Severe: organic material must be removed, high water table.	Very severe: high compressibility; very low bearing capacity; high water table.	Severe: high water table	Very severe: high water table; moderately rapid permeability.	Very severe: high water table.
Moderate: plastic subsoil.	Slight: subject to liquefaction and piping when wet.	Severe: little amelioration of leachate.	Severe substratum is rapidly permeable to very rapidly permeable.	Moderate where slopes are 0 to 12 percent; severe on steeper soils; danger of contaminating ground water.
Severe organic soil; high water table.	Severe where foundation is placed in loamy substratum; very severe for basements because of water table.	Severe: high water table	Very severe: high water table, moderate to moderately rapid permeability.	Very severe: high water table.
Slight on nearly level soils. Moderate on steeper soils; subsoil is plastic.	Slight	Severe: little amelioration of leachate.	Severe. substratum is rapidly permeable to very rapidly permeable.	Moderate: danger of contaminating ground water.
Slight on nearly level soils Moderate on steeper soils; subsoil is plastic.	Slight	Severe: little amelioration of leachate.	Severe: substratum is rapidly permeable.	Moderate: danger of contaminating ground water.
Moderate seasonal water table at a depth of 1 to 3 feet; moderate frost-heave potential in subsoil	Moderate: seasonal high water table restricts installation; basements subject to seasonal wetness	Severe: little amelioration of leachate.	Severe substratum has rapid permeability.	Severe: seasonal high water table; danger of contaminating ground water.
Moderate seasonal water table at a depth of 1 to 3 feet; moderate frost-heave potential in subsoil.	Moderate. seasonal high water table restricts installation; basements subject to seasonal wetness.	Severe little amelioration of leachate.	Severe substratum has rapid permeability.	Severe seasonal high water table; danger of contaminating ground water.
Moderate seasonal water table at a depth of 1 to 3 feet.	Moderate substratum has high stability and bearing capacity; severe for basements; seasonal high water table.	Severe. little amelioration of leachate; seasonal high water table.	Severe: substratum has rapid permeability; seasonal high water table.	Severe: seasonal high water table.
Moderate. plastic subsoil	Slight	Slight where slopes are 2 to 6 percent; moderate where slopes are 6 to 12 percent.	Moderate where slopes are 2 to 6 percent; severe on steeper soils; moderately permeable; stony in places.	Slight where slopes are 2 to 6 percent and moderate where slopes are 6 to 12 percent.
Severe high water table; frost-heave hazard; hauling and excavating difficult.	Severe. moderate bearing capacity; subject to liquefaction and piping; high water table; very severe for basements.	Severe: high water table.	Very severe: high water table; low stability; moderate permeability.	Very severe: high water table.

TABLE 10.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road subgrade and highway fill
*Kewaunee: KfB, KfC2	Surface layer fair; thin, subsoil poor; clayey; erodible.	Unsuitable: clayey	Poor. high shrink-swell potential; low bearing capacity; unstable when wet.
KgB	Fair subsoil and upper part of substratum clayey; lower part of substratum gravelly.	Fair poorly graded sand; includes some fines or gravel.	Subsoil poor; substratum good.
KhB, KhB2, KhC2, KhD2, KhE2, KlB, KlB2, KmE2. For Manawa part of KlB and KlB2, see Manawa series. For Sisson part of KmE2, see Sisson series.	Surface layer good; thin; subsoil poor; clayey; erodible.	Unsuitable· clayey	Poor: high shrink-swell potential; low bearing capacity; unstable when wet.
KkC3, KkD3, KkE3	Poor clayey	Unsuitable· clayey	Poor· high shrink-swell potential; low bearing capacity; unstable when wet.
Kibbie. KnA	Surface layer good, subsoil fair, unstable.	Poor: poorly graded fine sand with silt and clay layers in substratum.	Fair: highly susceptible to frost action; moderate stability; erodible.
Kolberg KoB, KoC2	Surface layer good; thin, subsoil fair; clayey, thin over bedrock.	Unsuitable clayey soil over limestone bedrock; source of limestone for crushing.	Subsoil fair; moderate shrink-swell potential and bearing capacity. Substratum is limestone bedrock.
Lamartine: LaA	Surface layer good; subsoil fair; clayey, erodible on slopes.	Poor. pockets of poorly graded sand and gravel occur in places in substratum.	Subsoil fair; moderate shrink-swell potential and bearing capacity. Substratum fair; moderately stable.
Manawa. MaA	Surface layer fair, sandy; subsoil poor, clayey.	Unsuitable: clayey	Poor high shrink-swell potential; low bearing capacity, unsuitable when wet.
McA	Surface layer good; subsoil poor; clayey.	Unsuitable. clayey	Poor: high shrink-swell potential; low bearing capacity; unsuitable when wet.

for town and country planning—Continued

Degree and kind of limitations for—				
Highway and street location	Foundations for low buildings	Sanitary landfill	Sewage lagoons	Disposal fields
Severe. highly plastic, cuts and fills have low stability.	Moderate. high shrink-swell potential; low bearing capacity and moderate compressibility	Moderate where slopes are 0 to 6 percent; severe on steeper soils; some ponding in pit can occur; muddy and slippery when wet.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent and severe on steeper soils, moderately slow to slow permeability.	Severe: moderately slow to slow permeability.
Severe. high shrink-swell potential in subsoil.	Slight	Moderate. permeability of lower substratum is rapid.	Severe: lower substratum is rapidly permeable.	Severe: upper substratum is slowly permeable.
Severe· highly plastic, cuts and fills have low stability	Moderate· moderate shrink-swell potential, low bearing capacity and moderate compressibility	Moderate where slopes are 0 to 6 percent; severe on steeper soils, some ponding in pit can occur; muddy and slippery when wet.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent and severe on steeper soils, moderately slow to slow permeability.	Severe: moderately slow to slow permeability.
Severe highly plastic, cuts and fills have low stability.	Moderate. moderate shrink-swell potential; low bearing capacity and moderate compressibility.	Moderate: some ponding in pit can occur; muddy and slippery when wet.	Severe sloping to steep soils; moderately slow permeability.	Severe: moderately slow to slow permeability.
Moderate seasonal perched water table at a depth of 1 to 3 feet, high frost-heave potential.	Moderate· moderate bearing capacity, subject to liquefaction and piping, severe for basements subject to seasonal wetness.	Moderate: seasonal perched water table, partial amelioration of leachate; unstable when wet.	Moderate: moderately slow permeability; low stability; seasonal perched water table.	Severe: seasonal perched water table.
Severe: limestone bedrock is at a depth of 20 to 40 inches.	Slight if footings rest on limestone bedrock, severe where bedrock needs to be excavated.	Severe. bedrock restricts use, danger of contaminating ground water	Severe. bedrock restricts use, danger of contaminating ground water	Severe. bedrock restricts use, danger of contaminating ground water.
Moderate. seasonal perched water table at a depth of 1 to 3 feet, moderate frost-heave potential in subsoil.	Moderate· moderate bearing capacity, seasonal perched water table may hinder installation, basements subject to seasonal wetness.	Moderate: seasonal perched water table, difficult to work in wet seasons.	Moderate: moderately slow permeability, seasonal perched water table.	Severe: seasonal perched water table.
Moderate: seasonal perched water table at a depth of 1 to 3 feet; highly plastic; moderate frost-heave potential.	Moderate: moderate shrink-swell potential; low bearing capacity, basements subject to seasonal wetness.	Severe: some ponding may occur, seasonal perched water table.	Moderate: slow permeability; seasonal perched water table.	Severe: seasonal perched water table, slow permeability.
Moderate· seasonal perched water table at a depth of 1 to 3 feet, highly plastic; moderate frost-heave potential.	Moderate moderate shrink-swell potential, low bearing capacity; basements subject to seasonal wetness.	Severe: some ponding may occur, seasonal high water table.	Moderate: slow permeability; seasonal perched water table.	Severe: seasonal perched water table; slow permeability.

TABLE 10.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road subgrade and highway fill
Manistee· MeB, MeC2	Surface layer poor; sandy; lower part of subsoil poor, clayey.	Poor: poorly graded sand with fines in subsoil; clayey substratum.	Subsoil good; substratum poor; high shrink-swell potential; low bearing capacity.
MfB	Surface layer poor; sandy; lower part of subsoil poor, clayey.	Poor: poorly graded sand with fines in subsoil; clayey substratum.	Subsoil good; substratum poor; high shrink-swell potential; low bearing capacity.
Markey· Mk	Surface layer and subsoil poor, erodible, oxidize rapidly.	Fair: poorly graded sand in substratum, high water table hinders excavation.	Unsuitable: unstable; high compressibility; very low bearing capacity.
Marsh Mr	Unsuitable ponded most of the year.	Unsuitable: no sand and gravel present.	Unsuitable poorly drained, low stability and bearing capacity
Menominee· MsB	Poor. surface layer sandy, loamy substratum	Poor: sand with fines in subsoil; loamy substratum	Good
Namur NaB, NaD	Good shallow to bedrock	Unsuitable· excellent source of limestone for crushing.	Fair· shallow to bedrock
Namur, wet subsoil variant Ne	Poor thin; high water table	Unsuitable· bedrock	Fair· shallow to bedrock
Ogden Od	Poor surface layer and subsoil are erodible and oxidize rapidly.	Unsuitable organic soil over clayey substratum.	Unsuitable: unstable, high compressibility, low bearing capacity.
*Onaway: OeB, OeC2	Surface layer fair; sandy; subsoil fair; thin, gravelly or stony in places.	Poor: pockets of poorly graded sand and gravel occur in places in substratum.	Subsoil fair; moderate shrink-swell potential and bearing capacity; unstable when wet.
OhA, OhB, OhD2, OlB For Sisson part of OlB, see Sisson series.	Surface layer good; thin; subsoil fair; thin, gravelly or stony in places.	Poor. pockets of poorly graded sand and gravel occur in places in substratum.	Subsoil fair; moderate shrink-swell potential and bearing capacity; unstable when wet.

for town and country planning—Continued

Degree and kind of limitations for—				
Highway and street location	Foundations for low buildings	Sanitary landfill	Sewage lagoons	Disposal fields
Moderate. subject to soil blowing, substratum is plastic.	Severe: high shrink-swell potential, low bearing capacity.	Moderate: difficult to work when wet, water ponds in pits.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent and severe on steeper soils; rapidly permeable in subsoil.	Severe· lower subsoil and substratum are slowly permeable.
Moderate· subject to soil blowing, substratum is plastic.	Severe: high shrink-swell potential, low bearing capacity	Moderate· difficult to work when wet; water ponds in pits.	Slight where slopes are 0 to 2 percent, moderate on steeper soils; rapidly permeable in subsoil.	Severe. lower subsoil and substratum are slowly permeable.
Severe: organic soil; high water table.	Severe: high water table; very severe for basements.	Severe: high water table.	Severe: high water table; rapidly permeable.	Very severe: high water table.
Very severe: flooded most of the year.	Very severe: flooded most of the year.	Very severe: nearly continuous high water table.	Very severe: high water table; generally flooded.	Very severe: high water table, generally flooded.
Moderate. subsoil subject to soil blowing.	Slight	Slight	Moderate: moderate permeability.	Moderate. moderate permeability.
Severe shallow to bedrock.	Slight where footing rests on bedrock; severe where bedrock must be excavated.	Severe: bedrock restricts use, danger of contaminating ground water.	Severe bedrock restricts use; danger of contaminating ground water.	Severe: bedrock restricts use; danger of contaminating ground water.
Severe· high water table; bedrock restricts developments.	Moderate. high water table, severe for basements, bedrock restricts development.	Very severe: shallow to bedrock; high water table.	Very severe: moderately rapid permeability; shallow to bedrock; high water table.	Very severe: shallow to bedrock; high water table.
Severe: organic soil; high water table.	Severe when placed in substratum, high shrink-swell potential, low bearing capacity; moderate shear strength; very severe for basements.	Very severe: high water table.	Severe: high water table, organic soil is unsuitable.	Very severe: high water table.
Slight on nearly level soils; moderate on steeper soils; subsoil is plastic.	Slight	Slight where slopes are 0 to 6 percent; moderate on steeper soils.	Moderate where slopes are 2 to 6 percent; severe on steeper soils; substratum has moderate permeability.	Slight where slopes are 0 to 6 percent; moderate on steeper soils.
Slight on nearly level soils, moderate on steeper soils; subsoil is plastic.	Slight	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent and severe on steeper soils.	Moderate where slopes are 0 to 6 percent, severe on steeper soils; substratum has moderate permeability.	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent and severe on steeper soils.

TABLE 10.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road subgrade and highway fill
Oshkosh: OmA, OmB	Surface layer fair; sandy, subsoil poor, clayey, erodible.	Unsuitable clayey	Poor: high shrink-swell potential, low bearing capacity, unstable when wet.
OnA, OnB, OnC2, OnD2, OnE2	Surface layer good, thin; subsoil poor; clayey, erodible.	Unsuitable: clayey	Poor: high shrink-swell potential; low bearing capacity, unstable when wet.
OoB	Surface layer good; thin, subsoil poor; clayey; erodible.	Unsuitable: clayey	Poor: high shrink-swell potential; low bearing capacity; unstable when wet.
OsA, OsB	Surface layer fair; clayey, subsoil poor, clayey; erodible.	Unsuitable: clayey	Poor: high shrink-swell potential; low bearing capacity; unstable when wet.
Pella: Pe	Surface layer good, thick; subsoil fair, clayey, high water table	Unsuitable silty to clayey	Poor moderate shrink-swell potential and bearing capacity; unstable when wet; high water table.
Poygan Po	Surface layer good; thin, subsoil poor, clayey; high water table	Unsuitable clayey	Poor high shrink-swell potential, low bearing capacity, unstable when wet, high water table.
Rodman. Mapped only in a complex with Casco soils.	Surface layer and subsoil poor, gravelly.	Good poorly graded to well-graded sand and gravel, contains stones and boulders in places.	Good highly stable; stony in places.
Roscommon Rs	Surface layer fair; sandy, subsoil poor; droughty, sandy; high water table.	Fair poorly graded sand substratum, high water table hinders excavation.	Poor: high water table, low stability unless confined; erodible.
Ruse Ru	Fair high water table	Unsuitable. bedrock	Poor poorly drained
Sebewa Sb	Surface layer good; subsoil poor, clayey; high water table.	Fair poorly graded to well-graded sand and gravel substratum, high water table.	Subsoil fair, moderate bearing capacity and stability, substratum good, highly stable.

for town and country planning—Continued

Degree and kind of limitations for—				
Highway and street location	Foundations for low buildings	Sanitary landfill	Sewage lagoons	Disposal fields
Moderate on nearly level soils, severe on steeper soils; highly plastic, cuts and fills have low stability.	Severe: high shrink-swell potential, low bearing capacity; moderate shear strength.	Severe: ponding, difficult to work when wet.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent.	Severe: slow permeability.
Moderate on nearly level soils; severe on steeper soils; highly plastic; cuts and fills have low stability.	Severe. high shrink-swell potential, low bearing capacity, moderate shear strength.	Severe: ponding; difficult to work when wet.	Slight where slopes are 0 to 2 percent; moderate where slopes are 2 to 6 percent; severe on steeper soils.	Severe: slow permeability.
Moderate: highly plastic; cuts and fills have low stability.	Moderate: moderate shrink-swell potential; moderate bearing capacity; moderate shear strength.	Moderate: ponding; difficult to work when wet.	Moderate: moderately slow permeability.	Severe: slow permeability.
Moderate: highly plastic; cuts and fills have low stability.	Severe: high shrink-swell potential; low bearing capacity, moderate shear strength.	Severe: ponding; difficult to work when wet.	Slight where slopes are 0 to 2 percent and moderate where slopes are 2 to 6 percent.	Severe: slow permeability.
Severe: less than 1 foot to permanent or seasonal water table, high frost-heave potential.	Severe: moderate bearing capacity and shear strength, moderate compressibility; very severe for basements; subject to wetness.	Severe: high water table.	Moderate: high water table; moderate to moderately slow permeability.	Very severe: high water table.
Severe· less than 1 foot to permanent or seasonal water table; highly plastic	Severe: high shrink-swell potential; low bearing capacity, moderate shear strength; very severe for basements; subject to wetness.	Severe. high water table.	Moderate: high water table.	Very severe: high water table.
Moderate: stones hinder hauling and grading operations.	Slight	Severe: little amelioration of leachate.	Severe: very rapidly permeable substratum.	Severe: very rapidly permeable substratum.
Severe. less than 1 foot to permanent or seasonal water table, hauling and excavating difficult.	Moderate· moderate bearing capacity, subject to liquefaction and piping when saturated, severe for basements, subject to wetness.	Severe· high water table	Very severe: high water table; rapidly permeable.	Very severe: high water table
Severe high water table; moderate shrink-swell potential.	Severe· high water table; moderate shrink-swell potential, very severe for basements.	Very severe· bedrock restricts development, high water table.	Very severe: bedrock restricts development; high water table	Very severe: bedrock restricts development, high water table.
Severe seasonal or permanent water table at depth of less than 1 foot; hauling and excavating difficult.	Severe high water table hinders installation; very severe for basements, subject to wetness.	Severe· high water table.	Very severe. substratum has rapid permeability, high water table.	Very severe: high water table, danger of contamination of ground water.

TABLE 10.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road subgrade and highway fill
Shawano SeC, SeD	Unsuitable: sandy; very droughty; erodible.	Fair: poorly graded fine or medium sand.	Fair: low stability unless confined; erodible.
SfB, SfC	Surface layer and subsoil poor; sandy; droughty; erodible.	Fair: poorly graded fine sand; some fines included.	Fair in substratum; low stability unless confined; erodible.
Shullsburg, wet variant: SgB	Surface layer good; subsoil poor; clayey; thin over bedrock.	Unsuitable: clayey soil over shale.	Poor in subsoil; high shrink-swell potential; low bearing capacity. Substratum poor; shale residuum or bedrock.
Sisson: ShB, ShC2, ShD2	Surface layer fair; sandy, thin, substratum fair; unstable.	Poor. poorly graded, fine, with silt and clay lenses.	Fair: moderate bearing capacity; unstable when wet, highly susceptible to frost action; erodible.
SnA, SnB	Surface layer good; thin; subsoil fair; unstable on slopes.	Poor. poorly graded, fine, with silt and clay lenses.	Fair: moderate bearing capacity, unstable when wet; highly susceptible to frost action; erodible.
Solona. SoA	Surface layer fair; sandy; subsoil fair; thin; gravelly or stony in places.	Poor. pockets of poorly graded sand and gravel occur in places in substratum.	Fair: moderate shrink-swell potential and bearing capacity.
SpA	Surface layer fair to good; thin, subsoil poor to fair; sandy; erodible; gravelly in places.	Poor pockets of poorly graded sand and gravel occur in places in substratum.	Fair: moderate shrink-swell potential and bearing capacity.
Stony and rocky land. Sr	Unsuitable: very little soil material present; stony.	Unsuitable none present	Unsuitable: most of area is bedrock outcrops.
Summerville: SuB, SuD2	Surface layer good, thin; subsoil poor; thin over limestone.	Unsuitable: loamy soil over limestone bedrock, source of limestone for crushing.	Fair: moderately stable. Substratum is limestone bedrock.
Summerville, clayey subsoil variant: SvB	Surface layer good; thin; subsoil poor; thin over limestone bedrock.	Unsuitable: loamy	Fair. moderate shrink-swell potential.

for town and country planning—Continued

Degree and kind of limitations for—				
Highway and street location	Foundations for low buildings	Sanitary landfill	Sewage lagoons	Disposal fields
Slight	Slight	Severe. danger of contaminating ground water.	Severe: rapid permeability.	Moderate where slopes are 6 to 12 percent and severe on steeper soils; danger of contaminating ground water.
Slight. subject to soil blowing, cuts and fills have low stability.	Slight	Severe: danger of contaminating ground water	Severe: rapid permeability.	Moderate: danger of contaminating ground water.
Severe· depth to shale is 2 to 4 feet, seasonal water table at a depth of 1 to 2 feet, highly plastic; seeps are common.	Severe subject to slippage; shale bedrock, very severe for basements; subject to wetness.	Severe impervious shale substratum; somewhat poorly drained.	Severe: substratum is shale bedrock.	Very severe: seasonal high water table; substratum slowly permeable.
Severe. moderate to high frost-heave potential; cuts and fills have low stability, highly erodible	Moderate moderate bearing capacity; subject to liquefaction and piping	Moderate where slopes are 12 percent and severe on steeper soils; partial amelioration of leachate.	Moderate where slopes are 6 percent and severe on steeper soils, low stability; difficult to compact.	Moderate where slopes are 12 percent and severe on steeper soils, filter fields difficult to maintain.
Severe moderate to high frost-heave potential; cuts and fills have low stability, highly erodible.	Moderate· moderate bearing capacity, subject to liquefaction and piping.	Moderate where slopes are 0 to 12 percent and severe on steeper soils, partial amelioration of leachate.	Moderate where slopes are 0 to 6 percent and severe on steeper soils, low stability, difficult to compact.	Moderate where slopes are 0 to 12 percent and severe on steeper soils, filter fields difficult to maintain
Moderate: seasonal water table at a depth of 1 to 3 feet.	Moderate seasonal high water table, severe for basements, subject to seasonal wetness.	Moderate· seasonal high water table, difficult to work in wet seasons.	Severe· substratum has moderate permeability, seasonal high water table.	Severe· seasonal high water table.
Moderate. seasonal water table at a depth of 1 to 3 feet.	Moderate seasonal high water table may hinder installation; moderate for basements, subject to seasonal wetness.	Moderate seasonal high water table; difficult to work in wet seasons.	Severe: substratum has moderate permeability; seasonal high water table.	Severe: seasonal high water table.
Severe: most of area is bedrock outcrops.	Severe without basements, bedrock, very severe for basements, bedrock.	Very severe: most of area is bedrock outcrops.	Very severe· most of area is bedrock outcrops.	Very severe· most of area is bedrock outcrops.
Severe limestone bedrock at a depth of less than 2 feet.	Severe shallow to limestone bedrock.	Severe: danger of contaminating ground water.	Severe: limestone bedrock restricts use.	Severe: bedrock restricts use; danger of contaminating ground water.
Severe less than 2 feet to limestone bedrock.	Severe: shallow to limestone bedrock.	Severe: danger of contaminating ground water.	Severe: limestone bedrock restricts use	Severe: bedrock restricts use, danger of contaminating ground water.

TABLE 10.—*Engineering interpretations*

Soil series and map symbols	Suitability as a source of—		
	Topsoil	Sand and gravel	Road subgrade and highway fill
Tedrow: TeA	Surface layer and subsoil poor; sandy; droughty, erodible.	Good poorly graded sand substratum.	Fair: low stability unless confined; seasonal high water table; erodible.
Wauseon. Wa	Surface layer fair; sandy, subsoil poor; sandy; high water table.	Poor· poorly graded sand with excessive fines in subsoil over clay.	Poor· poorly drained; high water table.
*Waymor WmB	Surface layer fair; sandy; subsoil fair; clayey; erodible on slopes.	Poor. pockets of poorly graded sand and gravel occur in places in substratum.	Fair. moderate shrink-swell potential and stability.
WoA, WoB, WoC2, WoD2, WsC, WsE For Casco and Sisson parts of WsC and WsE, see the respective series.	Surface layer good; thin; subsoil fair, clayey; erodible on slopes.	Poor: pockets of poorly graded sand and gravel occur in places in substratum.	Fair. moderate shrink-swell potential and stability.
Yahara YaA	Surface layer fair, sandy, subsoil fair, unstable.	Poor poorly graded fine sand with silt layers in substratum.	Fair. moderate bearing capacity; unstable when wet, highly susceptible to frost action; erodible.
YhA	Surface layer good; thick, subsoil fair, unstable.	Poor poorly graded fine sand with silt layers in substratum.	Fair moderate bearing capacity, unstable when wet, highly susceptible to frost action; erodible; seasonal high water table.

for town and country planning—Continued

	Degree and kind of limitations for—			
Highway and street location	Foundations for low buildings	Sanitary landfill	Sewage lagoons	Disposal fields
Moderate: seasonal water table at a depth of 1 to 3 feet; loose sand may hinder hauling; subject to soil blowing.	Moderate: seasonal high water table, subject to liquefaction and piping when wet, severe for basements; subject to seasonal wetness.	Severe little amelioration of leachate, seasonal high water table	Severe: rapid permeability; seasonal high water table.	Severe: seasonal high water table; danger of contaminating ground water.
Severe. less than 1 foot to permanent or seasonal water table, cuts and fills have low stability.	Severe: high water table; moderate shrink-swell potential and bearing capacity; severe for basements, subject to wetness.	Severe: high water table.	Moderate: high water table; substratum is slowly permeable.	Very severe: high water table.
Moderate: subsoil is plastic.	Slight	Slight	Moderate: moderate permeability.	Slight.
Slight where slopes are 0 to 2 percent and moderate on steeper soils; subsoil is plastic.	Slight	Slight where slopes are 0 to 6 percent; moderate where slopes are 6 to 12 percent and severe on steeper soils	Moderate where slopes are 0 to 6 percent and severe on steeper soils, moderate permeability.	Slight where slopes are 0 to 6 percent, moderate where slopes are 6 to 12 percent, and severe on steeper soils.
Severe seasonal water table at a depth of 1 to 3 feet; cuts and fills have low stability, seeps and springs in places.	Moderate moderate bearing capacity, subject to liquefaction and piping, severe for basements, subject to seasonal wetness.	Moderate· unstable when wet, seasonal high water table, partial amelioration of leachate	Moderate: moderate permeability; low stability when wet; difficult to compact; seasonal high water table	Severe· seasonal high water table
Severe seasonal water table at a depth of 1 to 3 feet below surface, cuts and fills have low stability; seeps and springs in places.	Moderate· moderate bearing capacity, subject to liquefaction and piping, severe for basements, subject to seasonal wetness	Moderate· unstable when wet, seasonal high water table, partial amelioration of leachate	Moderate· moderate permeability, low stability when wet; difficult to compact, seasonal high water table.	Severe seasonal high water table.

TABLE 11.—*Engineering interpretations for farm uses*

[Not included in this table, because their properties are too variable to estimate and onsite investigation generally is required, are the land types Borrow pits, Bp; Dumps, Du; Fill land, Fd; Gravel pits, Gp; Quarries, Qu; and Rough broken land, Ro. An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
Allendale: AdA, AeA	Rapid permeability in subsoil; slow permeability in substratum; seasonal high water table; dugout ponds feasible in some places.	Subsoil has poor stability; very pervious; substratum has fair stability and compaction characteristics; semipervious.	Sandy; low stability.	Seasonal high water table; surface or subsurface drainage feasible.	Sandy material; difficult to vegetate and stabilize.
Alluvial land· Au	Generally moderate permeability; subject to flooding; substratum varies.	Generally moderate permeability; substratum varies; piping hazard.	Subject to flooding; not suitable for some species.	Subject to flooding; dikes and surface drains feasible.	Generally not applicable.
Alluvial land, wet: Aw.	Generally moderate permeability; high water table; frequent flooding.	Subsoil and substratum have fair stability and compaction characteristics.	Difficult to vegetate and construct; frequent flooding.	Subsurface or surface drainage feasible; frequent flooding.	Not applicable.
Angelica: Ax	Moderate permeability.	Subsoil has fair to good stability and compaction characteristics; substratum has fair stability.	High water table; difficult to vegetate and construct.	Moderate permeability; high water table; subsurface or surface drainage feasible.	Not applicable.
Bellevue: Bc	Moderately slow permeability; subject to flooding.	Subsoil and substratum have fair to poor stability and compaction characteristics; moderate shrink-swell potential.	Erodible	Moderately slow permeability; subject to stream overflow; dikes and surface drainage feasible.	Generally not needed.
Bellevue, mottled subsoil variant: Bd	Moderately slow permeability; seasonal high water table; subject to flooding; dugout ponds feasible.	Subsoil and substratum have fair to poor stability and compaction characteristics; semipervious; high compressibility.	Seasonal wetness hinders construction and establishment of turf in places; siltation hazard.	Moderately slow permeability; seasonal high water table; subject to flooding; dikes and surface drainage feasible.	Generally not applicable.
Bonduel BnA	Moderate permeability through subsoil; fractured limestone at a depth of 20 to 40 inches.	Subsoil has fair to good stability and compaction characteristics; semipervious; substratum is fractured limestone.	Limestone may interfere with grading, seasonal high water table restricts cover growth.	Moderate permeability; seasonal high water table; bedrock at a shallow depth; subsurface or surface drainage feasible.	Limestone at a depth of 20 to 40 inches.

TABLE 11.—*Engineering interpretations for farm uses*—Continued

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
Boyer BrB, BrC2, BrD2, BrE.	Moderately rapid permeability through subsoil, rapid permeability in sandy substratum.	Subsoil has fair stability; fair to good compaction characteristics, pervious; piping hazard; substratum has poor stability; fair compaction characteristics, very pervious; piping hazard.	Difficult to establish and maintain vegetative cover.	Natural drainage is excessive.	Sandy material; difficult to vegetate and stabilize.
Briggsville: BtB	Moderately slow permeability.	Subsoil has fair to poor stability and compaction characteristics; semipervious; substratum has fair to good stability and compaction characteristics; semipervious.	Clayey subsoil; construction difficult.	Natural drainage is adequate.	Dense clayey subsoil; construction difficult.
Carbondale· Ca	Moderately rapid permeability; high water table, dugout ponds feasible.	Organic soils not suitable for embankments.	Seldom applicable	Moderately rapid permeability; high water table; subsurface drainage feasible.	Seldom applicable.
*Casco CcB, CcC2, CdE2 For Rodman part of CdE2, see Rodman series.	Moderate permeability through subsoil; rapid to very rapid permeability in sand and gravel substratum.	Subsoil has fair to good stability and compaction characteristics; semipervious, substratum has fair stability and fair to good compaction characteristics; very pervious.	Vegetation can be established where gravel substratum is not exposed.	Natural drainage is adequate.	Shallow to sand and gravel.
Cathro: Cm	Moderate permeability in substratum; high water table, dugout ponds feasible.	Organic material not suitable; substratum variable and ranges from poor to fair in stability and compaction characteristics.	Seldom applicable, difficult to establish and maintain good vegetative cover.	Moderate to moderately rapid permeability; high water table; subsurface or tile drainage feasible.	Generally not applicable.
Dresden· DdA, DrA	Moderate permeability through subsoil; rapid to very rapid permeability in substratum.	Subsoil has fair to good stability and compaction characteristics; semipervious; substratum has fair stability and fair to good compaction characteristics; very pervious.	Erodible	Natural drainage adequate.	Sand and gravel at a depth of 20 to 40 inches.

TABLE 11.—*Engineering interpretations for farm uses*—Continued

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
Dresden, mottled subsoil variant DeA, DsA	Moderate permeability through subsoil; sand and gravel substratum; seasonal high water table; dugout ponds feasible in places.	Subsoil has fair to good stability and compaction characteristics, semipervious, substratum has fair stability and fair to good compaction characteristics; very pervious.	Wetness hinders construction, in places water-tolerant grasses needed.	Moderately permeable subsoil, seasonal high water table, subsurface or surface drainage feasible.	Sand and gravel at a depth of 20 to 40 inches.
Fabius Fa	Moderate permeability through subsoil; rapid to very rapid permeability in substratum, seasonal high water table; dugout ponds feasible in places.	Subsoil has fair to good stability and compaction characteristics, semipervious, substratum has poor stability and fair compaction characteristics, very pervious.	Extensive shaping may expose sand and gravel substratum; in places water-tolerant grasses needed.	Moderate permeability; seasonal high water table; surface and subsurface drainage feasible.	Sand and gravel at a depth of 20 to 40 inches; wetness may hinder construction.
Hochheim: HoB, HoC2	Moderate permeability.	Subsoil has fair to good stability and compaction characteristics, thin; semipervious; substratum has fair stability and fair to good compaction characteristics; pervious.	Erodible	Natural drainage adequate.	Highly calcareous loamy glacial till at a shallow depth.
Keowns Ke	Moderate permeability, high water table; dugout pond feasible.	Piping hazard; poor stability and compaction characteristics; pervious.	Suitable grade is a concern, few grasses suited.	Moderate permeability; high water table, surface drainage feasible.	Not applicable.
*Kewaunee KfB, KfC2, KhB, KhB2, KhC2, KhD2, KhE2, KkC3, KkD3, KkE3, KlB, KlB2, KmE2 For Manawa part of KlB and KlB2, see Manawa series. For Sisson part of KmE2, see Sisson series.	Moderately slow to slow permeability.	Subsoil and substratum have fair to poor stability and compaction characteristics, semipervious, high shrink-swell potential; low shear strength.	Dense clayey subsoil, difficult to vegetate and to construct.	Moderately slow to slow permeability; land smoothing and surface drainage feasible.	Dense clayey subsoil, construction difficult.
KgB	Subsoil has slow permeability; gravelly substratum has very rapid permeability.	Gravelly substratum has very rapid permeability, often stony; subsoil has high shrink-swell potential; slow permeability.	Moderately slow to slow permeability.	Natural drainage is adequate.	Dense clayey subsoil, permeability is slow.

TABLE 11.—*Engineering interpretations for farm uses*—Continued

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
Kibbie KnA	Moderately slow permeability; seasonal high water table; dugout ponds in places.	Subsoil has fair to good stability and compaction characteristics; semipervious; substratum has poor stability and compaction characteristics; pervious; piping hazard.	Seasonal wetness hinders construction and the establishment of turf in places.	Moderate permeability, seasonal high water table; substratum generally unstable; subsurface or surface drainage feasible.	Substratum difficult to stabilize.
Kolberg KoB, KoC2.	Moderately slow permeability through subsoil; substratum is fractured limestone at a depth of 20 to 40 inches	Subsoil has fair to good stability and compaction characteristics; semipervious; substratum is fractured limestone bedrock.	Limestone bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Limestone bedrock at a depth of 20 to 40 inches.
Lamartine LaA	Moderately slow permeability	Subsoil and substratum have fair to good stability and compaction characteristics; semipervious; stony in places.	Seasonal wetness hinders construction and the establishment of turf in places.	Seasonal high water table; moderate permeability; surface or subsurface drainage feasible.	Highly calcareous loamy substratum.
Manawa MaA, McA.	Slow permeability in subsoil and substratum; seasonal high water table.	Subsoil and substratum have fair to poor stability and compaction characteristics; semipervious; high compressibility; low shear strength.	Dense clayey subsoil; seasonal high water table; difficult to vegetate and to construct.	Slow permeability; seasonal high water table; subsurface or surface drainage feasible.	Dense clayey subsoil; construction difficult.
Manistee MeB, MeC2, MfB	Rapid permeability in subsoil; slow permeability in clay substratum.	Subsoil has fair stability and compaction characteristics; pervious; substratum has high shrink-swell potential; semipervious.	Sandy; difficult to vegetate and stabilize.	Natural drainage is excessive	Sandy material; difficult to vegetate and stabilize.
Markey Mk	Moderately rapid to rapid permeability; high water table; dugout ponds feasible.	Organic soil unsuitable for embankments; substratum has poor stability; pervious; piping hazard.	Not applicable	Open ditch or tile	Not applicable.
Marsh Mr	Flooded most of the year	Variable characteristics; flooded most of the year.	Not applicable	Drainage generally not feasible or practical.	Not applicable.

TABLE 11.—*Engineering interpretations for farm uses*—Continued

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
Menominee: MsB	Moderate permeability through subsoil; moderately rapid permeability in the substratum.	Subsoil has fair to poor stability and fair to good compaction characteristics; pervious; substratum has fair stability and compaction characteristics; low shrink-swell potential.	Difficult to establish good sod; pervious.	Natural drainage is adequate.	Sandy material; difficult to vegetate and stabilize
Namur· NaB, NaD	Moderate permeability; shallow to bedrock.	Shallow to bedrock	Droughty; difficult to maintain good sod; shallow to bedrock.	Natural drainage is is adequate.	Shallow to bedrock.
Namur, wet variant· Ne.	Bedrock restricts construction	Thin bedrock restricts construction.	Bedrock restricts development; high water table.	Bedrock restricts development; surface drains feasible.	Shallow to bedrock.
Ogden· Od	Slow permeability in clayey substratum; high water table; dugout ponds feasible.	Organic material unsuitable; substratum has poor stability and composition; high shrink-swell potential.	Seldom applicable; difficult to establish and maintain good vegetative cover.	Slow permeability in clayey substratum; high water table; subsurface or tile drainage is feasible.	Organic soil unstable subject to soil blowing and subsidence.
*Onaway OeB, OeC2, OhA, OhB, OhD2, OlB For Solona part of OlB, see Solona series.	Moderate permeability through subsoil and substratum	Subsoil has fair to good stability and compaction characteristics; semipervious; substratum has fair stability and fair to good compaction characteristics; pervious.	Substratum is gravelly; highly erodible; difficult to vegetate.	Natural drainage is adequate.	Sandy loam substratum; often stony.
Oshkosh OmA, OmB, OnA, OnB, OnC2, OnD2, OnE2, OoB, OsA, OsB.	Slow permeability in subsoil and clayey substratum	Subsoil and substratum have fair to poor stability and compaction characteristics; semipervious; high compressibility; high shrink-swell potential.	Rapid runoff; slow permeability; dense, clayey soil may restrict cover growth; erodible.	Slow permeability; land smoothing and surface drainage feasible.	Dense clayey subsoil; construction difficult
Pella: Pe	Moderate to moderately slow permeability; high water table; dugout ponds feasible.	Subsoil and substratum have fair to good stability and compaction characteristics; semipervious.	Wetness hinders construction and establishment of turf.	Moderate to moderately slow permeability; high water table; surface or subsurface drainage feasible.	High water table hinders construction in places.

TABLE 11.—*Engineering interpretations for farm uses*—Continued

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
Poygan Po	Very slow permeability in subsoil and substratum; high water table; dugout ponds feasible	Subsoil and substratum have fair to poor stability and compaction characteristics; semipervious; high compressibility; high shrink-swell potential.	Dense clayey subsoil, high water table; construction difficult.	Very slow permeability; high water table; land smoothing, subsurface or surface drainage feasible	Not applicable.
Rodman Mapped only in a complex with Casco soils.	Moderate permeability in subsoil; very rapid permeability in substratum.	Substratum has fair stability and fair to good compaction characteristics; very pervious; often stony or cobbly.	Difficult to construct because of cobblestones; droughty; low fertility; difficult to establish vegetation.	Excessively drained	Shallow to gravel and sand.
Roscommon Rs	Rapid permeability, high water table, dugout ponds feasible.	Substratum has poor stability and fair compaction characteristics, very pervious; piping hazard.	Moderately erodible; wetness hinders construction in places.	Rapid permeability; high water table; substratum generally unstable; subsurface or surface drainage feasible.	Not applicable.
Ruse: Ru	Bedrock restricts construction, moderate permeability.	Bedrock restricts construction, moderate permeability.	Difficult to grade; bedrock hinders construction in places.	Bedrock restricts installation in places; surface drains feasible.	Not applicable.
Sebewa Sb	Moderate permeability through subsoil; sand and gravel substratum; high water table, dugout ponds feasible in places.	Subsoil has fair stability and good to fair compaction characteristics; semipervious; substratum has fair stability and fair to good compaction characteristics; very pervious.	Wetness hinders construction in places.	Moderate permeability in subsoil; high water table, surface or subsurface drainage feasible.	Generally not applicable.
Shawano: SeC, SeD, SfB, SfC	Rapid permeability	Subsoil and substratum have poor stability and fair compaction characteristics; pervious, erodible; piping hazard.	Sandy, difficult to vegetate and stabilize.	Natural drainage is excessive.	Sandy material, difficult to vegetate and stabilize.
Shullsburg SgB	Slow permeability in subsoil, substratum is impervious shale at a depth of 20 to 40 inches; seasonal high water table, dugout ponds feasible.	Subsoil has fair to poor stability and compaction characteristics, semipervious; substratum has impervious shale bedrock.	Wetness hinders construction in places, water-tolerant grasses are needed.	Slow permeability; seasonal high water table; bedrock at shallow depth; surface drainage feasible.	Shale bedrock at a depth of 20 to 40 inches; wetness hinders construction in places.

TABLE 11.—*Engineering interpretations for farm uses*—Continued

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
Sisson ShB, ShC2, ShD2, SnA, SnB.	Moderate permeability.	Subsoil has fair to good stability and compaction characteristics; semipervious; substratum has poor stability and compaction characteristics; piping hazard.	Low stability and erodible substratum.	Natural drainage is adequate.	Low stability; highly erodible.
Solona: SoA, SpA	Moderate permeability through subsoil and substratum; seasonal high water table; dugout ponds feasible in places.	Subsoil has fair to good stability and compaction characteristics; semipervious; substratum has fair stability and fair to good compaction characteristics; pervious.	Moderate permeability; seasonal high water table; highly calcareous loamy material at a depth of 20 to 40 inches.	Moderate permeability; seasonal high water table; subsurface or surface drainage feasible.	Highly calcareous loamy material at a depth of 20 to 40 inches.
Stony and rocky land Sr.	Bedrock outcrops over most of the surface.	Bedrock outcrops over most of the surface.	Not applicable	Natural drainage is excessive.	Not applicable.
Summerville. SuB, SuD2.	Moderate permeability through subsoil; fractured limestone at a depth of less than 20 inches.	Subsoil has fair to good stability and compaction characteristics; very thin; substratum is fractured limestone bedrock.	Shallow to limestone bedrock.	Natural drainage is adequate.	Shallow to limestone bedrock.
Summerville, clayey subsoil variant. SvB	Moderately slow permeability through subsoil, fractured limestone at a depth of less than 20 inches.	Subsoil has fair to good stability and compaction characteristics; very thin; substratum is fractured limestone bedrock.	Shallow to limestone bedrock.	Natural drainage is adequate.	Shallow to limestone bedrock; dense clayey subsoil.
Tedrow. TeA	Rapid permeability; seasonal high water table; dugout ponds feasible.	Subsoil and substratum have poor stability and fair compaction characteristics; very pervious, erodible; piping hazard	Sandy; difficult to vegetate and stabilize; seasonal high water table; soil blowing hazard	Rapid permeability; seasonal high water table; substratum generally unstable; subsurface or surface drainage feasible.	Generally not applicable.
Wauseon: Wa	Moderately rapid permeability through subsoil; slow permeability in clayey substratum; high water table; dugout ponds feasible.	Subsoil has fair stability and fair to good compaction characteristics, pervious; substratum has fair to good stability and compaction characteristics; semipervious.	Generally not applicable. Wetness hinders construction in places.	Slow permeability in the substratum, high water table; surface drainage feasible, tile drainage feasible in places.	Low stability; wetness hinders construction in places.

TABLE 11.—*Engineering interpretations for farm uses*—Continued

Soil type	Soil features affecting—				
	Farm ponds		Grassed waterways	Agricultural drainage	Terraces and diversions
	Reservoir areas	Dams, dikes, and embankments			
*Waymor. WmB, WoA, WoB, WoC2, WoD2, WsC, WsE For Casco and Sisson part of WsC and WsE, see their respective series.	Moderate permeability.	Subsoil has fair to good stability and compaction characteristics, semipervious; substratum has fair to good stability and compaction characteristics, pervious.	Highly calcareous loamy substratum at a depth of 20 to 40 inches.	Natural drainage is adequate.	Highly calcareous loamy substratum at a depth of 20 to 40 inches.
Yahara. YaA, YhA	Moderately permeable; seasonal high water table, dugout ponds feasible in places.	Subsoil and substratum have poor stability and compaction characteristics; pervious to semipervious; piping hazard.	Seasonal wetness hinders construction and establishment of turf in places.	Moderate permeability; seasonal high water table; substratum is unstable; surface drainage feasible.	Generally not applicable.

Engineering interpretations for town and country planning

Interpretations of engineering properties of the soils in Brown County are given in tables 10 and 11. Table 10 lists uses of soils for town and country planning, and table 11 lists farm uses. Some items, however, are useful to both groups. Soil characteristics that affect the selection, design, or application of treatment measures are mentioned, and limitation ratings for specific purposes are given. The ratings used are *very slight*, relatively free of limitations; *slight*, limitations are few and easy to overcome; *moderate*, limitations can be overcome by good management and careful design; *severe*, limitations are difficult to overcome; and *very severe*, limitations are so great that use of the soil for the specified purpose generally is unsound. Suitability of soils as a source of topsoil, sand and gravel, or road subgrade and highway fill is indicated by a rating of *very good*, *good*, *fair*, *poor*, or *unsuitable*.

In table 10 the suitability of the soils as a source of topsoil refers to the use of soil material as a topdressing for roadbanks, parks, gardens, and lawns. The ratings are based on the texture of the soil and on its content of organic matter. For example, a soil that is medium textured and high in content of organic matter has a suitability rating of good as a source of topsoil. However, a soil that is very fine textured or coarse textured and that is low in content of organic matter is regarded as poor or unsuitable.

The column showing the suitability of soils as a source of sand and gravel indicates soils that are underlain by sand and gravel within a depth of 5 feet. No distinction is made between mainly coarse-grained deposits and coarse-grained deposits that contain an appreciable amount of finer textured material. Individual test pits and laboratory analyses are necessary to make these determinations.

Soils suitable for road subgrade and highway fill generally are a mixture of fines, sand, and gravel. Soils that have high shear strength, low shrink-swell potential, and good compaction characteristics are good sources of road fill. These soils also have low susceptibility to frost action and a low stone content. Soils that have a clayey substratum generally are poor sources of road fill or are unsuitable for use as road fill.

The characteristics and qualities that affect the overall performance of the soil for the location and construction of highways, railroads, and airports are evaluated in the column under highway and street location. Commonly, only the subsoil and underlying material are considered, and ratings are for undisturbed soil without artificial drainage. Factors considered are texture, presence and thickness of organic material, depth to bedrock and presence of stones and boulders, depth to water table, flooding hazard, susceptibility to frost heave, stability of slopes, bearing capacity, and need for cut and fill.

Limitations of the soils for foundations of low buildings are those concerned primarily with the construction of buildings three stories or less in height. The underlying material is rated because it is assumed that foundations of such buildings will rest on natural, undisturbed soil. The limitations depend mainly on the bearing capacity, shear strength, and shrink-swell behavior of this material.

Soil features affecting the use of the soil for sanitary landfill are mainly concerned with contamination of ground water or surface water by excessive leaching or by surface runoff. The bottom of the site of a sanitary landfill should, ideally, be more than 12 feet above ground water, more than 6 feet above hard, unfractured bedrock,

and 12 feet above sandstone or fractured limestone. There should be few or no stones, slope should be less than 6 percent, and flooding should not be a hazard. Soil textures that remove maximum amounts of harmful substances while permitting passage of water are sandy loam, loam, silt loam, or sandy clay loam. Very heavy soils are undesirable because water percolates through them too slowly. Sandy, rapidly permeable or very rapidly permeable soils permit leachate to move through the soil with little or no removal of undesirable compounds.

Sewage lagoons function best in nearly level soils that transmit water slowly. A shallow lagoon allows for maximum aeration and bacterial activity. Features other than slope and permeability that affect limitations of soils for this use include the amount of coarse fragments, the amount of organic matter in the soil, and the hazard of flooding. Clayey soils that have a Unified classification of GC, SC, CL, or CH generally have slight limitations for sewage lagoons. The gravelly sandy and organic soils have severe limitations.

Limitations of soils for onsite sewage disposal systems are determined by the ability of the soil to absorb and dispose of sewage effluent without contaminating surrounding areas. Those soils that have moderate to severe limitations require onsite investigation and appropriate tests before suitability can be determined.

How well a sewage disposal system will work depends largely on the rate at which the septic tank effluent moves into and through the soil. Soil permeability should be moderate to rapid, and the percolation rate should be 60 minutes per inch or faster.

Other factors that affect the limitations of soils for sewage disposal systems are structural stability, ground water level, depth of the soil, types of underlying material, susceptibility to stream overflow, slope, and proximity to streams and lakes.

A water table that rises to the height of the subsurface tile forces the sewage effluent upward to the soil surface and creates an ill-smelling, unhealthy bog in the filter field. Soil material 3 feet thick between seasonal high ground water levels or indurated rock formations and the bottom of the trenches or filter beds provides adequate depth for the infiltration and purification of septic tank effluent in most soils.

On slopes of more than 12 percent, filter fields generally are difficult to lay out and construct, and seepage beds are impractical. On very steep slopes the effluent often flows laterally and seeps out on the ground surface.

Estate-type lots of more than 1 acre in size generally are suited to installation of filter fields large enough to compensate for slow soil permeability. In somewhat poorly drained and poorly drained soils, increased size of the filter field is of little value; however a larger lot provides a better chance for locating the filter field in a well-drained area.

Engineering interpretations for farm uses

Table 11 gives interpretations mainly for farm uses. Limitations for both reservoir areas and embankments are given for pond development. Soil features that influence limitations for pond reservoirs and embankments are ground water level, permeability, stoniness or depth to bedrock, strength and stability, shrink-swell potential, and organic-matter content. Unless otherwise specified, the entire soil profile is considered in these evaluations. The ratings given for reservoir areas are for undisturbed soils. The ratings given for embankments are for soil material that has been disturbed. Controlled compaction of embankments commonly results in increased density and lowered permeability. The terms "subsoil" and "underlying material" in the embankment column refer to soil material that has been removed from these horizons and placed in the embankment.

The limitations of soils for grassed waterways are based on soil stability, texture and thickness of soil material, ease in establishing and maintaining a suitable vegetative cover, and slope.

Some of the factors to be considered in drainage of soils are rate of water movement into and through the soil, restricting layers, depth to water table, and topographic positions. Both surface and subsurface drainage are considered.

Features of the soil that determine their limitations for terraces and diversions are soil stability, texture and thickness of soil material, stoniness and rockiness, and topography. Broad-base terraces are not suitable for slopes of more than 12 percent, but diversions can be used on steeper slopes.

Formation and Classification of the Soils

This section discusses factors that have affected the formation of soils in Brown County. It also explains the current system of classification, places the soils of the county into higher categories, and describes basic changes that affect the soils. The soil series represented in this county and a profile representative for each series are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the climate under which the soil material has accumulated and existed since accumulation; (2) the plant and animal life on and in the soil; (3) the relief, or lay of the land; (4) the physical and mineralogical composition of the parent material, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons.

Climate.—Climate exerts a great influence on the formation of soils because it not only affects the weathering processes but also determines the kinds of plants and animals in an area and controls the rate of growth of plants. Brown County has a cool, humid continental type of climate in which variations in temperature are great from summer to winter. During winter the soil-forming processes are largely inactive although some alternate freezing and thawing continue.

Plants and animals.—Plants and animals affect the formation of soils by providing organic matter and by transferring plant nutrients from the lower layers of the soil to the upper layers. They also effect changes in the structure and porosity of the soils.

Forest trees were the original vegetation in Brown County. Some of the soils in the northwestern part of the county formed under coniferous forest. These soils are classified as Spodosols and are exemplified in this county by the Menominee and Onaway soils. Most of the soils of this county formed under a deciduous forest in young calcareous parent material. These soils are classified as Alfisols and are exemplified in Brown County by soils of the Kewaunee, Oshkosh, and Waymor series.

Relief.—The effects of climate and plant and animal life are conditioned by relief. The topography of Brown County ranges from nearly level on the bottom lands to steep on the morainic parts of the uplands. In depressional areas, runoff is slow, and internal drainage generally is slow. Soils in depressions remain wet and cool. As a result, they develop mottling throughout their profiles, and because decomposition of surface litter is slow, they develop a thick surface layer that is high in organic-matter content. Examples of such soils are those of the Lamartine, Pella, and Poygan series.

Soils that formed in alluvium occur along streams and at the base of long, steep slopes. These soils receive fresh deposits of silt, clay, and sand at a rate faster than their horizons can develop, and their profiles do not exhibit specific horizonation as in older soils.

Typical soils on the uplands are those of the Kewaunee, Oshkosh, and Waymor series. Their profiles show distinct horizonation throughout. On some steep slopes, however, erosion may remove one or two of the upper horizons and alter the physical nature of the soils.

Parent material.—Parent material also affects the kind of soil profile that is formed and determines it almost entirely in places. The parent material of most soils in Brown County was deposited by glaciers or by melt water when the glaciers receded from this part of Wisconsin. The parent material of some of the soils along streams, however, is recent alluvium. The parent material of organic soils consists of plant remains that accumulated and were preserved under water in swamps or shallow lakes. The nature of the parent material has much to do with the texture, mineral composition, and chemical properties of the soil formed in it.

The parent material of soils in the southeastern part of Brown County consists of stony, calcareous, brown, loamy glacial drift. This drift covers most of Morrison Township and parts of Holland and New Denmark Townships. In it formed such soils as those of the Waymor series, more poorly drained counterparts of the Waymor series, and associated outwash soils.

Parent material throughout most of the rest of the county consists of calcareous, reddish-brown, clayey glacial drift. The Kewaunee, Kolberg, and Oshkosh soils formed in this kind of material. Thickness of the glacial drift over bedrock ranges from 1 foot or less near the Niagara escarpment to more than 100 feet in the eastern part of the county.

In the general vicinity of the escarpment, the reddish-brown clayey glacial till typical of the Kewaunee substratum is underlain by loamy drift at depths of 3 to 20 feet or more. Some exposures reveal wood fragments at the point of contact of contrasting materials. It is believed these fragments correlate with the Two Creeks forest bed, carbon 14 dated at about 11,400 years (*6*).

Time.—Time is needed for the changing of parent material into a soil. It may be much or little, but time is always required for horizon differentiation. Soils can have a profile that is well developed, a profile that is poorly developed, or a profile that is somewhere in between, depending on the length of time the soil-forming factors have been active. The Kewaunee and Waymor soils, for example, have moderately distinct horizons and are considered to be fairly mature. Soils formed in recently deposited alluvium, on the other hand, show little or no profile development. A few soils, such as those of the Angelica and Keowns series, are young but are older than soils formed in recently deposited alluvium. In most places their profile contains at least one diagnostic horizon.

The five factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are still unknown.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*5*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties and was adopted in 1965 (*8*). It is under continual study (*4*).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 12 shows the classification of each soil series of Brown County by family, subgroup, and order, according to the current system.

ORDERS.—The ten soil orders are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate these soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different kinds of climate. Table 12 shows that the six

soil orders in Brown County are Entisols, Inceptisols, Mollisols, Spodosols, Alfisols, and Histosols.

Entisols are soils that do not have natural genetic horisons or that have only very weakly expressed beginnings of such horizons. These soils do not have traits that reflect soil mixing caused by shrinking and swelling.

Inceptisols are soils that have one or more of the natural genetic horizons that form rather quickly and that do not represent significant illuviation or eluviation or extreme weathering. They are most often found on young, but not recent, land surfaces.

Mollisols are soils that have a thick, dark-colored surface layer containing colloids dominated by bivalent cations. The material in these soils has not been mixed by shrinking and swelling.

Spodosols are soils that have a spodic horizon. Spodic horizons are those in which organic matter, iron, and aluminum have accumulated. In calcareous parent material, formation of a spodic horizon does not begin until carbonates have been leached from the upper part of the profile. Spodic horizons usually form in relatively fresh parent material that contains unweathered primary min-

TABLE 12.—*Soil series classified according to the current system*

Soil series	Family	Subgroup	Order
Allendale	Sandy over clayey, mixed, frigid	Aqualfic Haplorthods	Alfisols.
Angelica	Fine-loamy, mixed, nonacid, frigid	Aeric Haplaquepts	Inceptisols
Bellevue	Fine-loamy, mixed, mesic	Fluventic Hapludolls	Mollisols.
Bellevue, mottled subsoil variant.	Fine-loamy, mixed, mesic	Aquic Fluventic Hapludolls	Mollisols.
Bonduel	Fine-loamy, mixed	Aquic Eutroboralfs	Alfisols.
Boyer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Briggsville	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Carbondale	Euic	Hemic Borosaprists	Histosols.
Casco	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Hapludalfs	Alfisols.
Cathro	Loamy, euic	Terric Borosaprists	Histosols.
Dresden [1]	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Mollic Hapludalfs	Alfisols.
Dresden, mottled subsoil variant	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Aquollic Hapludalfs	Alfisols
Fabius [2]	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Aquic Argiudolls	Mollisols.
Hochheim	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Keowns [3]	Coarse-loamy, mixed, nonacid, mesic	Mollic Haplaquepts	Inceptisols.
Kewaunee	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Kibbie	Fine-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Kolberg	Fine, mixed	Glossic Eutroboralfs	Alfisols
Lamartine	Fine-silty, mixed, mesic	Aquollic Hapludalfs	Alfisols
Manawa	Fine, mixed, mesic	Aquollic Hapludalfs	Alfisols
Manistee	Sandy over clayey, mixed, frigid	Alfic Haplorthods	Spodosols.
Markey	Sandy or sandy skeletal, euic	Terric Borosaprists	Histosols.
Menominee	Sandy over loamy, mixed, frigid	Alfic Haplorthods	Spodosols.
Namur	Loamy, mixed	Lithic Haploborolls	Mollisols.
Namur, wet variant	Loamy, mixed, frigid	Lithic Haplaquolls	Mollisols.
Ogden [4]	Clayey, euic, mesic	Terric Medisaprists	Histosols.
Onaway	Fine-loamy, mixed, frigid	Alfic Haplorthods	Spodosols.
Oshkosh	Very fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Pella	Fine-silty, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Poygan	Fine, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Rodman	Sandy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
Roscommon	Mixed, frigid	Mollic Psammaquents	Entisols.
Ruse	Loamy, mixed, nonacid, frigid	Lithic Haplaquepts	Inceptisols.
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Typic Argiaquolls	Mollisols.
Shawano	Mixed, frigid	Typic Udipsamments	Entisols.
Shullsburg, wet variant	Fine, mixed, mesic	Aquic Argiudolls	Mollisols
Sisson	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Solona	Fine-loamy, mixed	Aquic Eutroboralfs	Alfisols.
Summerville	Loamy, mixed, frigid	Entic Lithic Haplorthods	Spodosols.
Summerville, clayey subsoil variant.	Loamy, mixed, frigid	Entic Lithic Haplorthods	Spodosols.
Tedrow	Mixed, mesic	Aquic Udipsamments	Entisols.
Wauseon	Coarse-loamy over clayey, mixed, noncalcareous, mesic.	Typic Haplaquolls	Mollisols.
Waymor	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Yahara	Coarse-loamy, mixed, mesic	Aquic Hapludolls	Mollisols.

[1] These soils are taxadjuncts to the Dresden series because they have a B horizon that is redder than defined for the series.

[2] These soils are taxadjuncts to the Fabius series because they have colors that are redder than defined for the series.

[3] These soils are taxadjuncts to the Keowns series because they lack the free carbonates in the solum that are defined for the series.

[4] These soils are taxadjuncts to the Ogden series because they have a hemic layer that is slightly thicker than defined for the series.

erals or in nearly pure sand. If a parent material is rich in clay, the formation of a spodic horizon is generally delayed until eluviation or weathering has reduced the clay content below a certain level. Spodosols occur only in a humid environment.

Alfisols are soils that contain a horizon of clay accumulation. They lack a thick, dark-colored surface layer that contains colloids dominated by bivalent cations, but the base status of the lower horizons is not extremely low.

Histosols are deep organic soils or soils that have a thick organic surface layer. Since peat deposits are associated with free water, Histosols are saturated for at least part of the year unless they are artificially drained.

SUBORDERS.—Each order has been divided into suborders, primarily on the basis of the characteristics that produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUPS.—Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that contain a pan that interferes with the growth of roots or the movement of water. The features used include the self-mulching properties of clays, soil temperature, and major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium). The great group is not shown separately in table 12, because it is the last word in the name of the subgroup.

SUBGROUP.—Great groups are divided into subgroups, one representing the central, or typic, segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

FAMILIES.—Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—At the series level primary attention is given to a control section. Attention is centered on genetic horizons if they are well expressed. If the genetic horizons are not well expressed, or if they are thin, attention is centered on a corresponding portion of the regolith.

In table 12 the soils of Brown County are placed in some categories of the current system.

Basic Changes that Affect Soils

Differentiation of horizons in the soils of Brown County is the result of one or more of the following: accumulation of organic matter, leaching of carbonates and salts, translocation of silicate clay minerals, and reduction and transfer of iron.

Enough organic matter to form an A1 horizon has accumulated in the uppermost layers of all but a few soils in the county, but the quantity varies. The Shawano soils, for example, have a faint, thin A1 horizon that is low in organic-matter content; but the Dresden, Kibbie, Waymor and other soils have a thicker A1 horizon that is fairly high in organic-matter content. Much of the organic matter is in the form of humus.

Leaching of carbonates and salts has occurred in almost all soils. Its visible effect on horizon differentiation has been limited, but it has had an indirect effect in that it has facilitated the translocation of silicate clay minerals in some soils. Free carbonates and salts have been almost completely carried out of the profiles of some of the well-drained soils. Even in the wettest soils, through which water moves very slowly, some leaching is indicated by the lack of free carbonates and by an acid reaction.

The translocation of silicate clay minerals has contributed to the development of horizons in many soils of Brown County. In Dresden, Kewaunee, Kibbie, and other deep soils, silicate clay has accumulated in an illuvial B horizon that contains more total clay and more fine clay than the horizons above or below it. In Shawano and other soils, however, the illuvial horizon contains no more total clay than the underlying C horizon. Nearly all the soils that have a blocky structure contain clay films, some of which are thin and weakly expressed. The films occur as thin layers on ped faces, and the long axes of the clay particles lie parallel to the surface on which they are deposited. This translocated clay, where strongly expressed, fills the cracks of the soil and the crevices and openings left by plant roots, animals, or insects.

The horizon from which clay has been carried is identified in these soils by its bleached appearance, friable consistence, and generally platy structure.

Nearly structureless soils, such as those of the Yahara series, have a slight accumulation of silicate clay in the B horizon. They do not have clay films on ped surfaces, however, because they have no peds with prominent cleavage planes, nor have they been subjected to intensive or prolonged weathering. The clay in the illuvial horizon of these soils generally occurs as a coating on the individual sand grains and is parallel to the surface of the grain. A few pores in this horizon have weak, discontinuous, clay films.

The reduction and transfer of iron oxides has occurred in all the very poorly drained, poorly drained, and somewhat poorly drained soils. This process, called gleying, is most pronounced in the Poygan soils, and it is indicated by a gray color in the subsurface layers. After iron has been reduced, it may be removed completely from the soil profile. More commonly in Brown County, it has moved a short distance and stopped either in the horizon of its origin or in an adjoining horizon. Segregated iron forms yellowish-red, strong-brown, or yellowish-brown mottles. Black manganese spots are also common.

General Nature of the County

This section gives facts about the history of Brown County. It also describes the physiography, drainage, water supply, and climate and gives facts about trends in farming and in other land uses. Farm statistics used are from records of the U.S. Bureau of the Census.

History of Brown County

The region of which Brown County is a part was ceded by France to England in 1760, and by England to the United States in 1783.

The city of Green Bay, located on Green Bay in the northern part of Brown County, is one of the oldest settlements of the northwest. Jean Nicolet landed there in 1634, Father Claude Allouez came in 1669, and Joliet and Marquette came in 1673. When a trading post was established in 1683, the settlement became an important fur-trading point. DeLanglade is believed to have done the first farming in Brown County in 1745. A military road to Chicago was completed in 1830, and government land surveys were started in 1834.

Brown County was established in 1818 while Wisconsin was still a part of the Northwest Territory. It included parts or all of many counties of northeastern Wisconsin and was reduced to its present boundaries in 1851.

About 50 settlers were in the area in 1785. The tide of foreign immigration began about 1848, and the 1860 census reported 11,795 inhabitants. The pioneer settlers were engaged in fur trading and only such farming as was necessary to supply their needs. After 1840 the lumber industry grew rapidly. The immense quantity and desirable quality of the pine, combined with water outlets, brought prosperity. Around 1860, however, large acreages were opened to wheat farming, and lumbering was replaced as the principal industry. Around 1900, when wheat failed because of the chinch bug, dairy farming began to expand. In 1953 milk cows made up three-fourths of the value of livestock on Brown County farms. Farmers have also given considerable attention to cash crops. Barley, sweet corn, flaxseed, canning peas, and vegetables are most important.

The excellent harbor at Green Bay favored the development of industry and farming. On June 19, 1873, the first railroad to Green Bay was completed, and others soon followed. Because the area is served by a network of good primary and secondary highways, farm produce is moved mostly by truck.

Physiography and Drainage

Two bedrock formations control the physiography of Brown County. The thick, prominent Niagara limestone that underlies the eastern part of Brown County gave rise to the eastern ridges of Wisconsin (fig. 17), but glacial action has modified the topography of this area. Glacial ice has scoured bedrock in one place and deposited hills of glacial material in another. Along much of the escarpment, the Valders ice left a narrow strip of relatively level land. The rest of the county to the east, excluding the southeastern part, is a rolling till plain. It generally is well drained but in places has hummocky micro-relief and many small, wet depressions. Marshy and swampy areas and steep, sharply dissected benches occur east of the city of Green Bay. In the southeastern part of the county, in the vicinity of the city of Denmark, the Cary glacier formed a moraine between two lobes. This is part of the well-known Kettle Moraine, which is extremely hilly and choppy and has many poorly drained depressions.

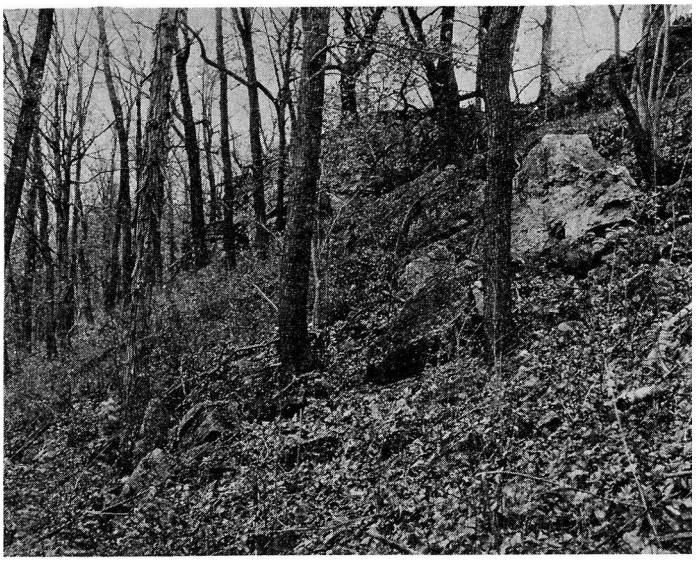

Figure 17.—**Part of the Niagara escarpment, which is a conspicuous topographic feature in Brown County. In this county it is mapped as Stony and rocky land.**

The western part of Brown County rests on the backslope of the Galena limestone formation. This formation, which tilts gently to the east, is considerably lower than the Niagara Formation and forms the eastern lowlands of Wisconsin. Superimposed on this level to undulating lowland are glacial landforms. These are made up of several long, benchlike, sandy ridges, believed to be eskers, and a wide, rolling moraine ridge. Most swampy areas are extinct glacial lakes. The western and southern edges of Green Bay, noticeably flat and marshy, were covered by the Bay during glacial times.

The valley of the Fox River owed its origin to a dip in the eastern edge of the Galena limestone formation. This depression, about 4 miles wide, borders the foot of the Niagara escarpment throughout the county. It is nearly level to gently rolling.

Drainage patterns in Brown County developed largely under the influence of bedrock formations. In the eastern part of Brown County, the somewhat elevated position of the Niagara escarpment forces most of the drainage to the east and southeast. Headwaters of the Kewaunee, Neshota, Branch, and Devil Rivers are in this area; and these streams flow east and southeast into Lake Michigan. The Neshota, Branch, and Devil Rivers merge with other streams beyond the county border. Bower and Baird Creeks flow west, and they are the only streams in Brown County to do so. A gap in the escarpment between Kolb and Bay Settlement permits them to flow into the East River.

West of the escarpment all streams, except the Suamico River, flow northeast (parallel to the Niagara escarpment) into Green Bay. The Fox and East Rivers and Ashwaubenon Creek furnish drainage for the Fox River Valley. Trout and Duck Creeks provide water outlets for the north-central part of western Brown County. The former flows into Duck Creek before reaching Green Bay. Most areas of the townships of Pittsfield and Suamico are drained by the Suamico River, which flows east into Green Bay.

The low, level position of all of Brown County west of the escarpment has produced shallow stream channels, except in places where the streams have cut through glacial landforms. In places in these areas, the appearance of the relief is very striking.

Water Supply

Water supplies in Brown County are obtained from all the geological formations. The most important sources, however, are the surface deposits of sand and gravel that underlie the reddish clayey drift and the sandstone strata that underlie the Galena-Platteville dolomite (*10*). The ground-water level in the valleys of the Fox River and Duck Creek usually is not far below the surface and generally is at a depth of less than 100 feet. In the uplands of the eastern part of the county, water generally is between depths of 100 and 200 feet. The shale underlying the Niagara limestone is impervious, and there are also some shaly seams within the dolomite which favorably influence the water-bearing characteristics of the Niagara Formation.

Water contained within the sandstone underlying the Galena-Platteville limestone is under strong pressure; and in the low areas of the Fox River Valley and adjacent to Green Bay, strong flows are developed.

Springs at the base of the limestone escarpment east of Green Bay are a common source of water in the eastern part of the county. In this locality, wherever the shale outcrops along the bluff, springs are likely to issue either directly from the shale or from the overlying drift some distance from the ledge.

Climate of Brown County [4]

The climate of Brown County is continental and is characterized by the marked changes in weather that are common to locations in the interior of large land masses of the middle latitudes. The nearby waters of Green Bay, Lake Michigan, and Lake Winnebago exert a strong modifying influence on the climate. The length of a day varies from approximately 15½ hours late in June to 9 hours late in December.

Winters are cold and snowy, but summers are mostly warm with periods that are hot and humid. Spring and fall are sometimes short and are often a mixture of summer and winter climatic conditions. Weather changes can be expected every few days in winter and spring. The following climatological information and data are based on observations taken at Green Bay, and they are fairly representative of the county at large. Average temperature and precipitation data are shown in table 13. The probabilities of critical temperatures in spring and fall are shown in table 14.

During the period of record, the extreme high temperature was 104° F. and the low, −36°. The number of days in which the temperature reached 90° or higher averaged 8 per year, ranging from 20 in 1955 to none in 1950 and 1951. The average number of days per year in which the

[4] By HANS E. ROSENDAL, climatologist for Wisconsin, National Weather Service, U.S Department of Commerce.

TABLE 13.—*Temperature and precipitation representative of Brown County, Wisconsin*

[All data from Green Bay, Brown County, Wis.]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average maximum	Average minimum	Average total	One year in 10 will have—		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
						Less than—	More than—		
	°F	°F	°F	°F.	Inches	Inches	Inches	Number	Inches
January	25	9	41	−17	1. 2	0. 5	2. 3	24	4 5
February	27	9	42	−12	1. 1	. 4	2. 3	19	5. 7
March	36	20	58	−1	1. 3	. 9	2. 8	13	4. 7
April	52	34	76	19	2. 5	1. 3	4. 0	2	3. 1
May	65	44	81	29	3. 1	1. 5	4 6	[1]	0
June	75	56	90	39	3. 4	2. 0	5. 3	0	0
July	82	59	91	45	2. 7	1. 5	4 8	0	0
August	80	58	90	42	2. 8	1 9	4 5	0	0
September	71	50	87	31	2. 9	1. 2	6. 0	0	0
October	60	39	80	23	1. 9	. 6	3. 8	[1]	0
November	41	27	63	8	1. 9	. 8	3. 8	2	1. 5
December	29	15	48	−10	1. 2	5	2 4	11	2. 7
Year	54	35	[2] 93	[3] −19	26. 0	19. 0	32. 5	71	4. 5

[1] Less than 0.5 day.

[2] Average annual maximum.

[3] Average annual minimum.

TABLE 14.—*Probabilities of last freezing temperature in spring and first in fall*

[All data from Green Bay, Brown County, Wis.]

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F or lower
Spring:					
1 year in 10 later than	April 7	April 14	April 22	May 6	May 21
2 years in 10 later than	April 2	April 8	April 17	May 1	May 16
5 years in 10 later than	March 22	March 28	April 6	April 21	May 6
Fall:					
1 year in 10 earlier than	November 6	October 30	October 21	October 9	September 23
2 years in 10 earlier than	November 12	November 4	October 26	October 15	October 3
5 years in 10 earlier than	November 23	November 15	November 6	October 26	October 14

temperature dropped to 0° or below is 22, varying from as many as 55 days in 1963 to as few as 10 in 1944.

Precipitation for the period May through September accounted for about 57 percent of the annual average total. The probability of 1 inch or more of rainfall in a 7-day period during the summer is greatest in the early part of June, when such a period occurs more than 3 years in 10. The probability of a 7-day period (trace or less of precipitation) during the summer is greatest in August. During that month a 7-day dry period occurs about 2 years in 10. Intensities of about 1.25 inches in 1 hour, 1.80 inches in 6 hours, and 2.40 inches in 24 hours can be expected about once in 2 years.

Snowfall ranged from as much as 63 inches in the winter of 1961–62 to as little as 21 inches in the winter of 1967–68. The average date of the first snowfall of 1 inch or more is November 25. This snowfall occurs by November 1 in 1 year in 10, and by December 20 in 9 years in 10.

Thunderstorms occurred on an average of 38 days a year, ranging from 52 days to 28. Hail fell on an average of 2 days a year. The range of frequency is from no hail to hail 7 days a year. Violent windstorms associated with thunderstorms or squall lines occasionally pass over the area. In the 50-year period between 1916 and 1966, 10 tornadoes were confirmed in Brown County.

Prevailing winds are from the northwest in winter and from the southwest for the remaining months, but northeast winds are not infrequent throughout the year because of topographical effects. Average windspeed ranges from 14 miles per hour in November to about 9 miles per hour in July and August. Windspeed averages less than 4 miles per hour about 8 percent of the time, 4 to 12 miles per hour 54 percent of the time, 13 to 31 miles per hour 37 percent of the time, and greater than 31 miles per hour about 1 percent of the time. Winds of the highest velocity generally are from the northwest, west, or southwest.

Possible sunshine averaged between 60 and 70 percent for the months of June through August during the period of record; near 40 percent for November, December, and January; and between 50 and 60 percent for the remaining months.

The average date of the last freeze in spring is May 6 and of the first in fall, October 14. The growing season, defined as the number of days between the last freeze in spring and the first in fall, averages 161 days.

The freeze data are calculated for Green Bay; but minimum temperatures may vary considerably across the county on calm, clear nights, depending on the topography and kinds of soil in the area. Valleys generally are several degrees cooler than areas at higher elevation.

Farming

In 1968 slightly more than 75 percent of the total acreage of Brown County was in farms. Dairying is the main source of farm income.

The number of farms and farmers is steadily declining, but the size and value of individual farms is increasing. The number of farms decreased from 2,388 in 1959 to 1,920 in 1968. Of the 1,920 farms, 1,328 were dairy farms. The average size of farms increased from 122 acres in 1959 to 133 acres in 1968. The total area in farms was 254,619 acres in 1968, as compared to 292,995 acres in 1959.

In 1968 more than 50 percent of the soils, or about 178,000 acres, was used for growing crops. Only 13.8 percent, or 46,300 acres, was wooded. In 1959 about 11,000 acres were used exclusively for pasture, but the acreage in pasture has decreased somewhat since that time. Two-thirds of the county's woodland is also grazed.

The major crops in Brown County and the proportionate acreage planted to them are as follows: alfalfa, 25 to 32 percent; oats, 15 to 19 percent; corn, 10 to 19 percent; and clover timothy, 1 to 4 percent. Peas and sweet corn are minor crops grown in the county and truck crops are also grown on a small acreage.

The number of heifers and milk cows, sheep, and chickens has declined, but the number of hogs has remained relatively stable.

Numbers of livestock on farms in the county in 1969 were as follows:

Livestock	*Number*
Cattle and calves	55,000
Heifers and milk cows	43,900
Hogs	36,350
Chickens (4 months old and older)	78,000
Sheep	700

Trends in Land Use [5]

The population of Brown County in 1970 was about 135,000, and projections are that this number will increase to 229,000 by 1985.

From 1960 to 1965 in the Green Bay metropolitan area, the acreage in developed residential land increased 13 percent, that used for commercial purposes increased 12 percent, and that used by industry increased 11 percent. Projected land use for these purposes for 1985 is slightly under 21,000 acres, compared to 12,400 acres in 1965.

The number of small farms continues to decrease, and much of the land is being taken over by larger, more efficient units. The land-use trend is reflected in census information, which indicates that between 1940 and 1968 the number of farms declined from 3,312 to 1,920, and the total acreage in farms decreased from 307,992 to 254,619. These figures indicate a decline of about 41 percent in the number of farms, and that 53,373 acres used as farmland in 1940 was used for other purposes in 1968. This information is slightly misleading because the definition of the term "farm" changed during the period 1950 to 1960. This change, however, affected the data only slightly.

These trends dictate that proper land use is of utmost importance. This problem is further compounded, because in addition to the direct effects of the tremendous population growth, there is added pressure for uses related to population, such as parks, highways, and airports.

Approximately 77 percent of the soils in the county are poorly suited to uses that require the installation of septic tanks.

All of these trends have resulted in a more rapid increase in land value than that caused by inflation, and these trends are expected to continue.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. Following are terms for available water capacity used in this soil survey and their approximate quantitative value:

	Inches
Very high	More than 12
High	9 to 12
Moderate	6 to 9
Low	3 to 6
Very low	0 to 3

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Blowout. An excavation produced by wind action in loose soil, usually sand.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger

Soft—When dry, breaks into powder or individual grains under very slight pressure.

Cemented—Hard and brittle; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

[5] By ERNEST EHRBAR, agricultural agent, Brown County, Wisconsin.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage, soil (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artifical drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blockly structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Outwash (geology). Cross-bedded gravel, sand, and silt deposited by melt water as it flowed from glacial ice.

Peat. Unconsolidated soil material, largely undecomposed organic matter, that has accumulated where there has been excess moisture.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Puddled soil. A soil that is dense, massive, and without regular structure because it has been artificially compacted when wet. Commonly, a puddled soil is a clayey soil that has been tilled when wet.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) single grain (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or

flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Till, glacial (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable granular structure A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

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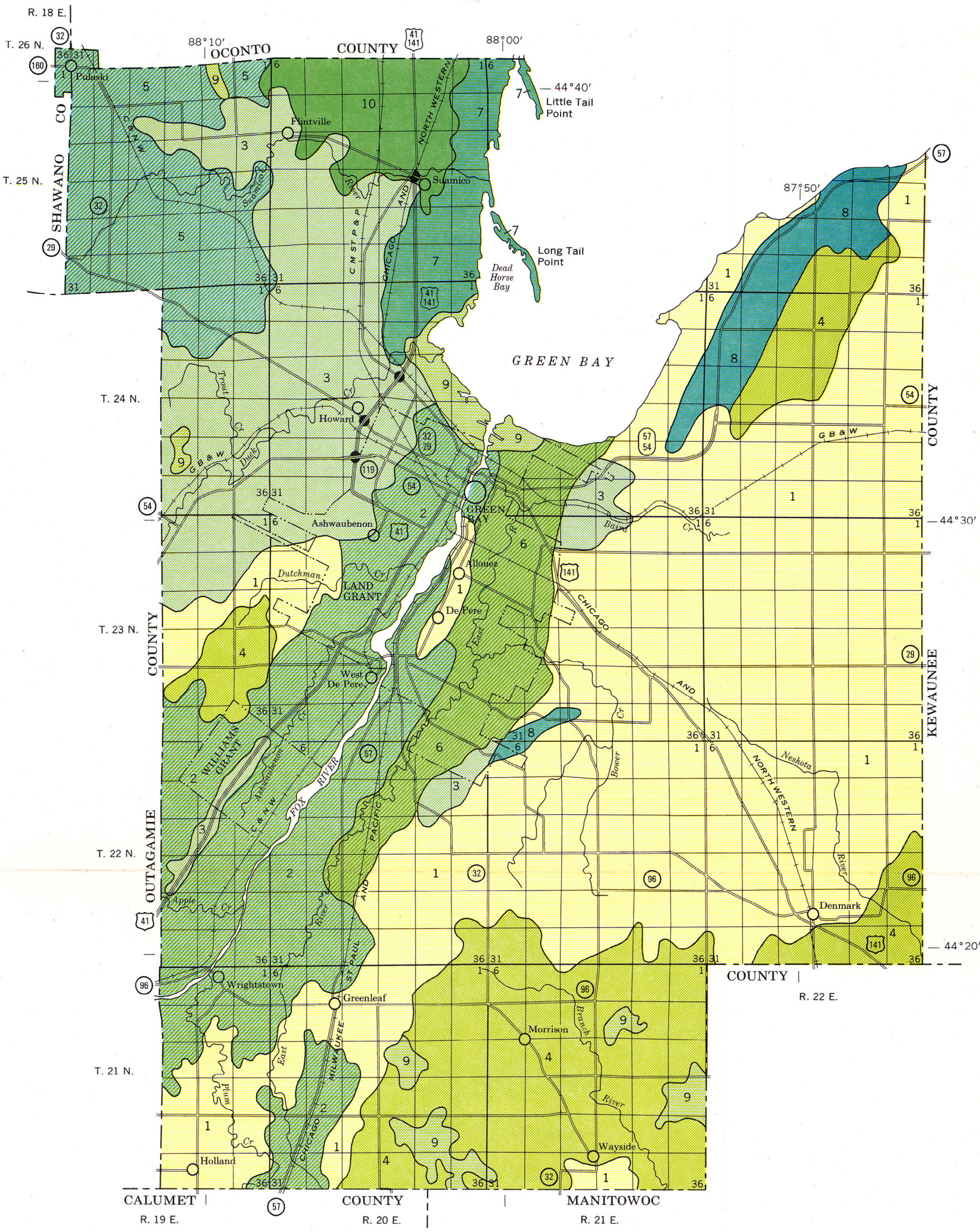


SOIL ASSOCIATIONS

1 — Kewaunee-Manawa association: Deep, well-drained to somewhat poorly drained, nearly level to steep soils that have a dominantly clayey subsoil; on glacial till plains and ridges

2 — Oshkosh-Manawa association: Deep, well-drained to somewhat poorly drained, nearly level to steep soils that have a dominantly clayey subsoil; on glacial lake plains dissected by narrow V-shaped valleys

3 — Shawano-Boyer-Sisson association: Deep, excessively drained and well-drained, nearly level to steep soils that have a sandy and loamy subsoil; on outwash plains and ridges and glacial lake plains

4 — Waymor-Hochheim association: Deep, well-drained, nearly level to moderately steep soils that have a loamy subsoil; on glacial till plains and ridges

5 — Onaway-Solona association: Deep, well-drained and somewhat poorly drained, nearly level to moderately steep soils that have a loamy subsoil; on glacial till plains

6 — Oshkosh-Allendale-Tedrow association: Deep, well-drained to somewhat poorly drained, nearly level to steep soils that have a clayey and sandy subsoil; on glacial lake plains dissected by narrow V-shaped valleys

7 — Tedrow-Roscommon association: Deep, somewhat poorly drained and poorly drained, nearly level soils that have a sandy subsoil; on glacial lake and outwash plains

8 — Namur-Summerville-Kolberg association: Very shallow to moderately deep, nearly level to moderately steep soils that have a loamy and clayey subsoil; underlain by limestone bedrock; on glacial till plains

9 — Carbondale-Cathro-Marsh association: Very poorly drained, nearly level organic soils and marshes

10 — Shawano-Tedrow-Roscommon association: Deep, excessively drained to poorly drained, nearly level to steep soils that have a sandy subsoil; on glacial lake and outwash plains and ridges

Compiled 1972

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WISCONSIN AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

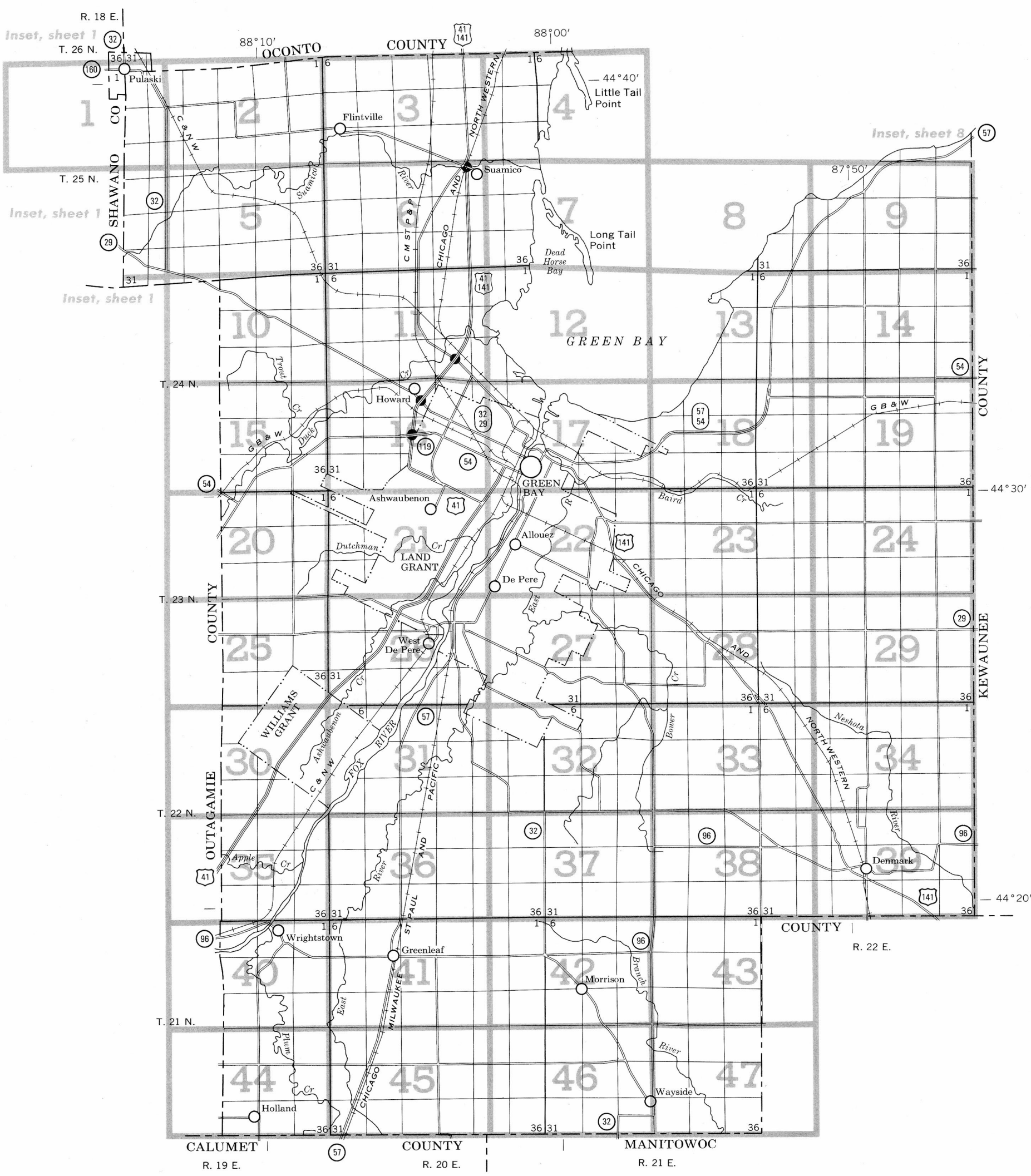
BROWN COUNTY, WISCONSIN

Scale 1:190,080

1 0 1 2 3 4 Miles

N

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

BROWN COUNTY, WISCONSIN

Scale 1:190,080

1 0 1 2 3 4 Miles

N

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. A technical description of a profile that is representative of the soil series is part of the description of the first mapping unit of each series. For complete information about a capability unit, refer to the subsection "Capability grouping." Other information is in tables as follows:

Acreage and extent of soils, table 1, page 11.
Predicted yields of crops, table 2, page 56.
Trees for woodland and ornamental planting, table 3, page 60.
Shrub and vine planting guide, table 4, page 64.

Habitat elements for wildlife in Brown County, table 5, page 67.
Suitability of soils for wildlife habitat, table 6, page 68.
Recreational uses of soils, table 7, page 72.
Engineering uses of soils, tables 8, 9, 10, and 11, pages 80 to 109.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group	Wildlife group	Shrub and vine group
			Symbol	Page	Number	Number	Symbol
AdA	Allendale loamy fine sand, 0 to 3 percent slopes	10	IIIw-6	52	7	5a	C
AeA	Allendale fine sandy loam, 0 to 3 percent slopes	12	IIIw-6	52	7	5a	C
Au	Alluvial land	12	IIw-11	50	1	7	A
Aw	Alluvial land, wet	12	Vw-14	54	9	5b	C
Ax	Angelica silt loam	12	IIw-1	49	7	5b	C
Bc	Bellevue silt loam	13	IIw-11	50	9	7	A
Bd	Bellevue silty clay loam, mottled subsoil variant	14	IIw-11	50	9	5a	C
BnA	Bonduel loam, 0 to 3 percent slopes	14	IIw-5	50	7	5a	C
Bp	Borrow pits	14	-----	--	---	8	---
BrB	Boyer loamy fine sand, 2 to 6 percent slopes	15	IIIs-4	53	4	3	B
BrC2	Boyer loamy fine sand, 6 to 12 percent slopes, eroded	15	IIIe-7	52	4	3	B
BrD2	Boyer loamy fine sand, 12 to 20 percent slopes, eroded	15	IVe-7	54	4	3	B
BrE	Boyer loamy fine sand, 20 to 30 percent slopes	15	VIe-7	55	4	3	B
BtB	Briggsville silt loam, 2 to 6 percent slopes	16	IIe-6	49	2	2	A
Ca	Carbondale muck	16	IIIw-9	53	10	6	C
CcB	Casco loam, 2 to 6 percent slopes	17	IIIe-3	52	5	3	B
CcC2	Casco loam, 6 to 12 percent slopes, eroded	17	IVe-3	53	5	3	B
CdE2	Casco-Rodman complex, 12 to 35 percent slopes, eroded	18	VIe-3	54	5	3	B
Cm	Cathro muck	18	IIIw-8	53	10	6	C
DdA	Dresden sandy loam, 1 to 3 percent slopes	19	IIIs-4	53	1	1	A
DeA	Dresden sandy loam, mottled subsoil variant, 0 to 2 percent slopes	19	IIw-5	50	7	5a	C
DrA	Dresden silt loam, 1 to 3 percent slopes	19	IIs-1	50	1	1	A
DsA	Dresden silt loam, mottled subsoil variant, 1 to 3 percent slopes	20	IIw-5	50	7	5a	C
Du	Dumps	20	-----	--	---	8	---
Fa	Fabius silt loam	20	IIw-5	50	7	5a	C
Fd	Fill land	20	-----	--	---	1	---
Gp	Gravel pits	21	-----	--	---	8	---
HoB	Hochheim loam, 2 to 6 percent slopes	21	IIe-1	48	1	1	A
HoC2	Hochheim loam, 6 to 12 percent slopes, eroded	21	IIIe-1	51	1	1	A
Ke	Keowns silt loam	22	IIIw-3	52	7	5b	C
KfB	Kewaunee sandy loam, 2 to 6 percent slopes	22	IIe-6	49	2	2	A
KfC2	Kewaunee sandy loam, 6 to 12 percent slopes, eroded	22	IIIe-6	52	2	2	A
KgB	Kewaunee loam, gravelly substratum, 2 to 6 percent slopes	23	IIe-6	49	2	2	A
KhB	Kewaunee silt loam, 2 to 6 percent slopes	23	IIe-6	49	2	2	A
KhB2	Kewaunee silt loam, 2 to 6 percent slopes, eroded	23	IIe-6	49	2	2	A
KhC2	Kewaunee silt loam, 6 to 12 percent slopes, eroded	23	IIIe-6	52	2	2	A
KhD2	Kewaunee silt loam, 12 to 20 percent slopes, eroded	23	IVe-6	53	2	2	A
KhE2	Kewaunee silt loam, 20 to 30 percent slopes, eroded	24	VIe-6	55	2	2	A
KkC3	Kewaunee soils, 6 to 12 percent slopes, severely eroded	24	IVe-6	53	2	2	A
KkD3	Kewaunee soils, 12 to 20 percent slopes, severely eroded	24	VIe-6	55	2	2	A
KkE3	Kewaunee soils, 20 to 30 percent slopes, severely eroded	24	VIIe-6	55	2	2	A
KlB	Kewaunee-Manawa complex, 2 to 6 percent slopes	24	IIe-6	49	2	2	C
KlB2	Kewaunee-Manawa complex, 2 to 6 percent slopes, eroded	24	IIe-6	49	2	2	C
KmE2	Kewaunee-Sisson complex, 15 to 30 percent slopes, eroded	24	IVe-6	53	2	2	A
KnA	Kibbie silt loam, 1 to 3 percent slopes	25	IIw-2	50	7	5a	C
KoB	Kolberg silt loam, 1 to 6 percent slopes	26	IIe-2	48	2	1	A
KoC2	Kolberg silt loam, 6 to 12 percent slopes, eroded	26	IIIe-2	51	2	1	A
LaA	Lamartine silt loam, 0 to 3 percent slopes	27	IIw-2	50	7	5a	C
MaA	Manawa sandy loam, 1 to 3 percent slopes	27	IIw-2	50	7	5a	C
McA	Manawa silty clay loam, 1 to 3 percent slopes	27	IIw-2	50	2	5a	C
MeB	Manistee loamy fine sand, 2 to 6 percent slopes	28	IVs-3	54	3	3	A
MeC2	Manistee loamy fine sand, 6 to 14 percent slopes, eroded	28	IVs-3	54	3	3	A
MfB	Manistee fine sandy loam, 2 to 6 percent slopes	28	IIIe-4	52	3	3	A
Mk	Markey muck	29	IVw-7	54	10	6	C
Mr	Marsh	29	VIIIw-15	55	11	6	D

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group	Wildlife group	Shrub and vine group
			Symbol	Page	Number	Number	Symbol
MsB	Menominee loamy fine sand, 2 to 6 percent slopes	30	IIIe-4	52	4	1	B
NaB	Namur silt loam, 1 to 6 percent slopes	30	VIs-5	55	6	8	B
NaD	Namur silt loam, 6 to 20 percent slopes	30	VIs-5	55	6	8	B
Ne	Namur silt loam, wet variant	31	VIs-5	55	7	5b	C
Od	Ogden muck	31	IIIw-8	53	10	6	C
OeB	Onaway sandy loam, 2 to 6 percent slopes	32	IIe-2	48	1	1	A
OeC2	Onaway sandy loam, 6 to 12 percent slopes, eroded	32	IIIe-2	51	1	1	A
OhA	Onaway loam, 0 to 2 percent slopes	32	IIs-1	50	1	1	A
OhB	Onaway loam, 2 to 6 percent slopes	32	IIe-2	48	1	1	A
OhD2	Onaway loam, 12 to 20 percent slopes, eroded	32	IVe-1	53	1	1	A
OlB	Onaway-Solona complex, 2 to 6 percent slopes	33	IIe-2	48	1	1	A
OmA	Oshkosh sandy loam, 0 to 2 percent slopes	33	IIs-7	50	2	2	A
OmB	Oshkosh sandy loam, 2 to 6 percent slopes	33	IIe-6	49	2	2	A
OnA	Oshkosh silt loam, 0 to 2 percent slopes	33	IIs-7	50	2	2	A
OnB	Oshkosh silt loam, 2 to 6 percent slopes	34	IIe-6	49	2	2	A
OnC2	Oshkosh silt loam, 6 to 12 percent slopes, eroded	34	IIIe-6	52	2	2	A
OnD2	Oshkosh silt loam, 12 to 20 percent slopes, eroded	34	IVe-6	53	2	2	A
OnE2	Oshkosh silt loam, 20 to 30 percent slopes, eroded	34	VIe-6	55	2	2	A
OoB	Oshkosh silt loam, loamy substratum, 2 to 6 percent slopes	34	IIe-6	49	2	2	A
OsA	Oshkosh silty clay loam, 0 to 2 percent slopes	34	IIs-7	50	2	2	A
OsB	Oshkosh silty clay loam, 2 to 6 percent slopes	34	IIe-6	49	2	2	A
Pe	Pella silt loam	35	IIw-1	49	7	5b	C
Po	Poygan silty clay loam	35	IIw-1	49	7	5b	C
Qu	Quarries	36	-----	--	---	8	---
Ro	Rough broken land	36	VIIe-6	55	1	8	A
Rs	Roscommon loamy fine sand	36	IVw-5	54	8	5b	C
Ru	Ruse silt loam	37	IIIw-6	52	7	5b	C
Sb	Sebewa silt loam	38	IIw-5	50	7	5b	C
SeC	Shawano fine sand, rolling	38	VIs-3	55	4	3	B
SeD	Shawano fine sand, hilly	38	VIIs-9	55	4	3	B
SfB	Shawano loamy fine sand, 2 to 6 percent slopes	38	IVs-3	54	4	3	B
SfC	Shawano loamy fine sand, 6 to 12 percent slopes	38	VIs-3	55	4	3	B
SgB	Shullsburg silt loam, wet variant, 2 to 6 percent slopes	39	IIw-5	50	7	5a	A
ShB	Sisson fine sandy loam, 2 to 6 percent slopes	39	IIe-1	48	1	1	A
ShC2	Sisson fine sandy loam, 6 to 12 percent slopes, eroded	40	IIIe-1	51	1	1	A
ShD2	Sisson fine sandy loam, 12 to 20 percent slopes, eroded	40	IVe-1	53	1	1	A
SnA	Sisson silt loam, 0 to 2 percent slopes	40	I-1	48	1	1	A
SnB	Sisson silt loam, 2 to 6 percent slopes	40	IIe-1	48	1	1	A
SoA	Solona sandy loam, 1 to 3 percent slopes	41	IIw-2	50	7	5a	C
SpA	Solona loam, 1 to 3 percent slopes	41	IIw-2	50	7	5a	C
Sr	Stony and rocky land	41	VIIIs-10	55	11	8	D
SuB	Summerville loam, 1 to 6 percent slopes	42	IIIe-3	52	5	8	B
SuD2	Summerville loam, 6 to 20 percent slopes, eroded	42	IVe-3	53	5	8	B
SvB	Summerville silt loam, clayey subsoil variant, 1 to 6 percent slopes	42	IIIe-3	52	5	8	B
TeA	Tedrow loamy fine sand, 0 to 3 percent slopes	43	IVw-5	54	8	5a	C
Wa	Wauseon fine sandy loam	43	IIIw-6	52	7	5b	C
WmB	Waymor sandy loam, 2 to 6 percent slopes	44	IIe-1	48	1	1	A
WoA	Waymor silt loam, 0 to 2 percent slopes	44	I-1	48	1	1	A
WoB	Waymor silt loam, 2 to 6 percent slopes	44	IIe-1	48	1	1	A
WoC2	Waymor silt loam, 6 to 12 percent slopes, eroded	44	IIIe-1	51	1	1	A
WoD2	Waymor silt loam, 12 to 20 percent slopes, eroded	45	IVe-1	53	1	1	A
WsC	Waymor-Casco-Sisson complex, 3 to 12 percent slopes	45	IIe-1	48	1	1	A
WsE	Waymor-Casco-Sisson complex, 12 to 25 percent slopes	45	IVe-1	53	1	1	A
YaA	Yahara fine sandy loam, 0 to 3 percent slopes	45	IIw-2	50	7	5a	C
YhA	Yahara silt loam, 0 to 3 percent slopes	46	IIw-2	50	7	5a	C

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

BROWN COUNTY, WISCONSIN

UNIVERSITY OF WISCONSIN, DEPARTMENT OF SOIL SCIENCE
WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY
WISCONSIN AGRICULTURAL EXPERIMENT STATION

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2 or 3, in the symbol shows that the soil is eroded or severely eroded.

SYMBOL	NAME
AdA	Allendale loamy fine sand, 0 to 3 percent slopes
AeA	Allendale fine sandy loam, 0 to 3 percent slopes
Au	Alluvial land
Aw	Alluvial land, wet
Ax	Angelica silt loam
Bc	Bellevue silt loam
Bd	Bellevue silty clay loam, mottled subsoil variant
BnA	Bonduel loam, 0 to 3 percent slopes
Bp	Borrow pits
BrB	Boyer loamy fine sand, 2 to 6 percent slopes
BrC2	Boyer loamy fine sand, 6 to 12 percent slopes, eroded
BrD2	Boyer loamy fine sand, 12 to 20 percent slopes, eroded
BrE	Boyer loamy fine sand, 20 to 30 percent slopes
BtB	Briggsville silt loam, 2 to 6 percent slopes
Ca	Carbondale muck
CcB	Casco loam, 2 to 6 percent slopes
CcC2	Casco loam, 6 to 12 percent slopes, eroded
CdE2	Casco-Rodman complex, 12 to 35 percent slopes, eroded
Cm	Cathro muck
DdA	Dresden sandy loam, 1 to 3 percent slopes
DeA	Dresden sandy loam, mottled subsoil variant, 0 to 2 percent slopes
DrA	Dresden silt loam, 1 to 3 percent slopes
DsA	Dresden silt loam, mottled subsoil variant, 1 to 3 percent slopes
Du	Dumps
Fa	Fabius silt loam
Fd	Fill land
Gp	Gravel Pit
HoB	Hochheim loam, 2 to 6 percent slopes
HoC2	Hochheim loam, 6 to 12 percent slopes, eroded
Ke	Keowns silt loam
KfB	Kewaunee sandy loam, 2 to 6 percent slopes
KfC2	Kewaunee sandy loam, 6 to 12 percent slopes, eroded
KgB	Kewaunee loam, gravelly substratum, 2 to 6 percent slopes
KhB	Kewaunee silt loam, 2 to 6 percent slopes
KhB2	Kewaunee silt loam, 2 to 6 percent slopes, eroded
KhC2	Kewaunee silt loam, 6 to 12 percent slopes, eroded
KhD2	Kewaunee silt loam, 12 to 20 percent slopes, eroded
KhE2	Kewaunee silt loam, 20 to 30 percent slopes, eroded
KkC3	Kewaunee soils, 6 to 12 percent slopes, severely eroded
KkD3	Kewaunee soils, 12 to 20 percent slopes, severely eroded
KkE3	Kewaunee soils, 20 to 30 percent slopes, severely eroded
KlB	Kewaunee-Manawa complex, 2 to 6 percent slopes
KlB2	Kewaunee-Manawa complex, 2 to 6 percent slopes, eroded
KmE2	Kewaunee-Sisson complex, 15 to 30 percent slopes, eroded
KnA	Kibbie silt loam, 1 to 3 percent slopes
KoB	Kolberg silt loam, 1 to 6 percent slopes
KoC2	Kolberg silt loam, 6 to 12 percent slopes, eroded
LaA	Lamartine silt loam, 0 to 3 percent slopes
MaA	Manawa sandy loam, 1 to 3 percent slopes
McA	Manawa silty clay loam, 1 to 3 percent slopes
MeB	Manistee loamy fine sand, 2 to 6 percent slopes
MeC2	Manistee loamy fine sand, 6 to 14 percent slopes, eroded
MfB	Manistee fine sandy loam, 2 to 6 percent slopes
Mk	Markey muck
Mr	Marsh
MsB	Menominee loamy fine sand, 2 to 6 percent slopes
NaB	Namur silt loam, 1 to 6 percent slopes
NaD	Namur silt loam, 6 to 20 percent slopes
Ne	Namur silt loam, wet variant
Od	Ogden muck
OeB	Onaway sandy loam, 2 to 6 percent slopes
OeC2	Onaway sandy loam, 6 to 12 percent slopes, eroded
OhA	Onaway loam, 0 to 2 percent slopes
OhB	Onaway loam, 2 to 6 percent slopes
OhD2	Onaway loam, 12 to 20 percent slopes, eroded
OlB	Onaway-Solona complex, 2 to 6 percent slopes
OmA	Oshkosh sandy loam, 0 to 2 percent slopes
OmB	Oshkosh sandy loam, 2 to 6 percent slopes
OnA	Oshkosh silt loam, 0 to 2 percent slopes
OnB	Oshkosh silt loam, 2 to 6 percent slopes
OnC2	Oshkosh silt loam, 6 to 12 percent slopes, eroded
OnD2	Oshkosh silt loam, 12 to 20 percent slopes, eroded
OnE2	Oshkosh silt loam, 20 to 30 percent slopes, eroded
OoB	Oshkosh silt loam, loamy substratum, 2 to 6 percent slopes
OsA	Oshkosh silty clay loam, 0 to 2 percent slopes
OsB	Oshkosh silty clay loam, 2 to 6 percent slopes
Pe	Pella silt loam
Po	Poygan silty clay loam
Qu	Quarries
Ro	Rough broken land
Rs	Roscommon loamy fine sand
Ru	Ruse silt loam
Sb	Sebewa silt loam
SeC	Shawano fine sand, rolling
SeD	Shawano fine sand, hilly
SfB	Shawano loamy fine sand, 2 to 6 percent slopes
SfC	Shawano loamy fine sand, 6 to 12 percent slopes
SgB	Shullsburg silt loam, wet variant, 2 to 6 percent slopes
ShB	Sisson fine sandy loam, 2 to 6 percent slopes
ShC2	Sisson fine sandy loam, 6 to 12 percent slopes, eroded
ShD2	Sisson fine sandy loam, 12 to 20 percent slopes, eroded
SnA	Sisson silt loam, 0 to 2 percent slopes
SnB	Sisson silt loam, 2 to 6 percent slopes
SoA	Solona sandy loam, 1 to 3 percent slopes
SpA	Solona loam, 1 to 3 percent slopes
Sr	Stony and rocky land
SuB	Summerville loam, 1 to 6 percent slopes
SuD2	Summerville loam, 6 to 20 percent slopes, eroded
SvB	Summerville silt loam, clayey subsoil variant, 1 to 6 percent slopes
TeA	Tedrow loamy fine sand, 0 to 3 percent slopes
Wa	Wauseon fine sandy loam
WmB	Waymor sandy loam, 2 to 6 percent slopes
WoA	Waymor silt loam, 0 to 2 percent slopes
WoB	Waymor silt loam, 2 to 6 percent slopes
WoC2	Waymor silt loam, 6 to 12 percent slopes, eroded
WoD2	Waymor silt loam, 12 to 20 percent slopes, eroded
WsC	Waymor-Casco-Sisson complex, 3 to 12 percent slopes
WsE	Waymor-Casco-Sisson complex, 12 to 25 percent slopes
YaA	Yahara fine sandy loam, 0 to 3 percent slopes
YhA	Yahara silt loam, 0 to 3 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor

Highway markers
- National Interstate
- U. S.
- State
- County

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Airport

Forest fire or lookout station

Lock

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

BROWN COUNTY, WISCONSIN — SHEET NUMBER 1

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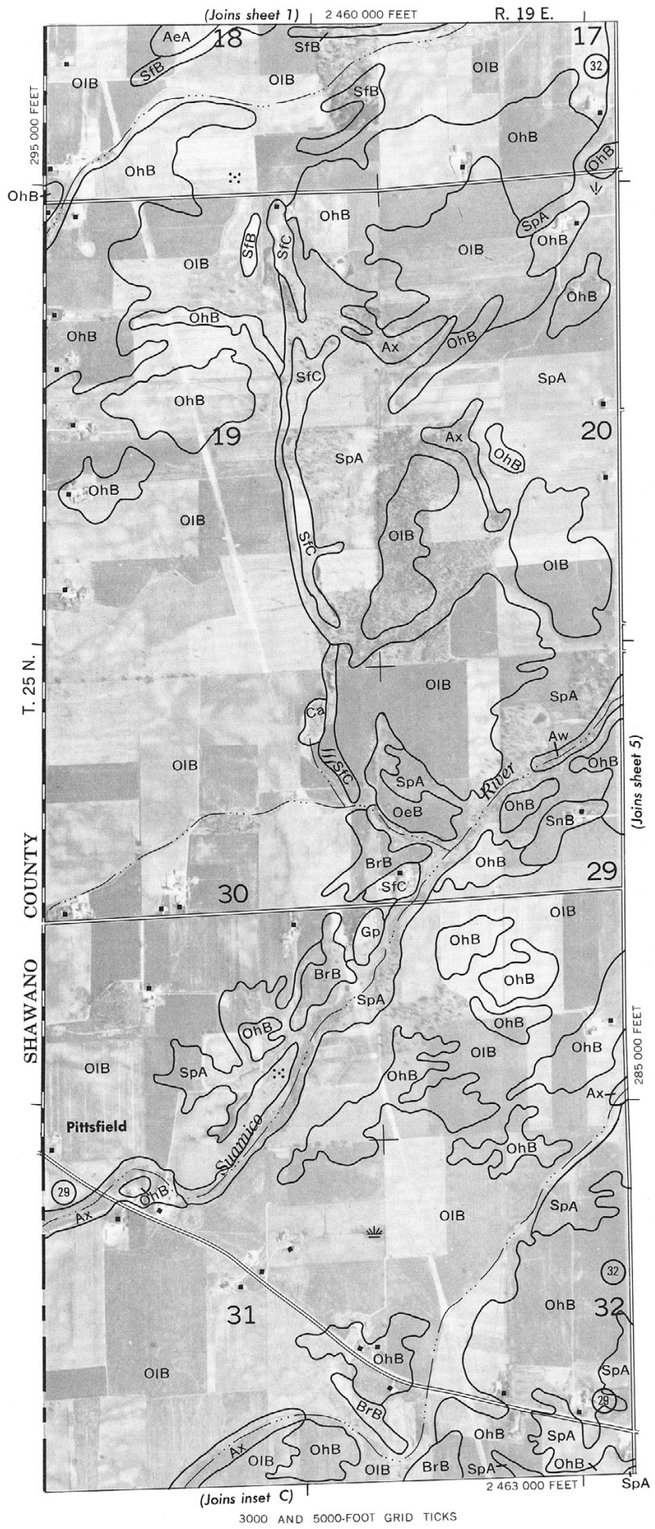
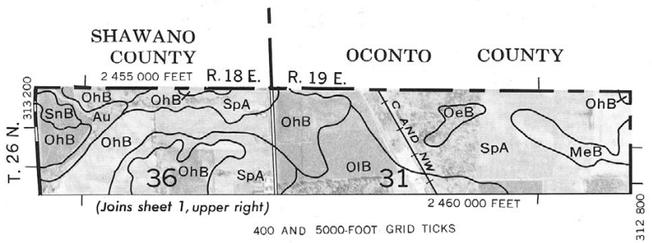
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.
Land division corners are approximately positioned on this map.

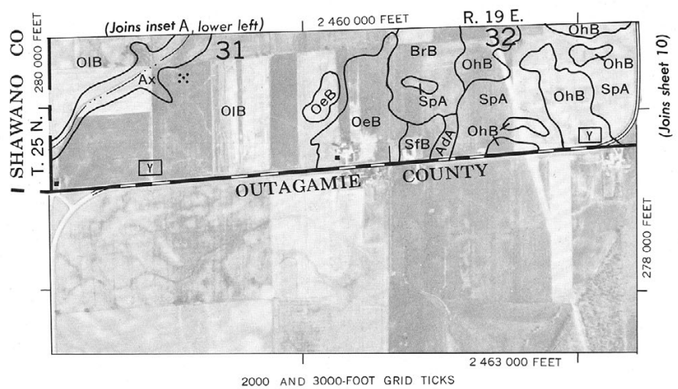
BROWN COUNTY, WISCONSIN NO. 1



INSET A



INSET B



INSET C

1 Mile
5000 Feet
Scale 1:20000

BROWN COUNTY, WISCONSIN — SHEET NUMBER 2

2

N

2 485 000 FEET

310 000 FEET

300 000 FEET

2 465 000 FEET

OCONTO COUNTY

R. 19 E.

T. 25 N.

1 Mile

5 000 Feet

0 0

Scale 1:20000

1 1000 1/4

1/2 2000

3/4 3000

1 4000

1 5000

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 5)

BROWN COUNTY, WISCONSIN NO. 2

Land division corners are approximately positioned on this map.

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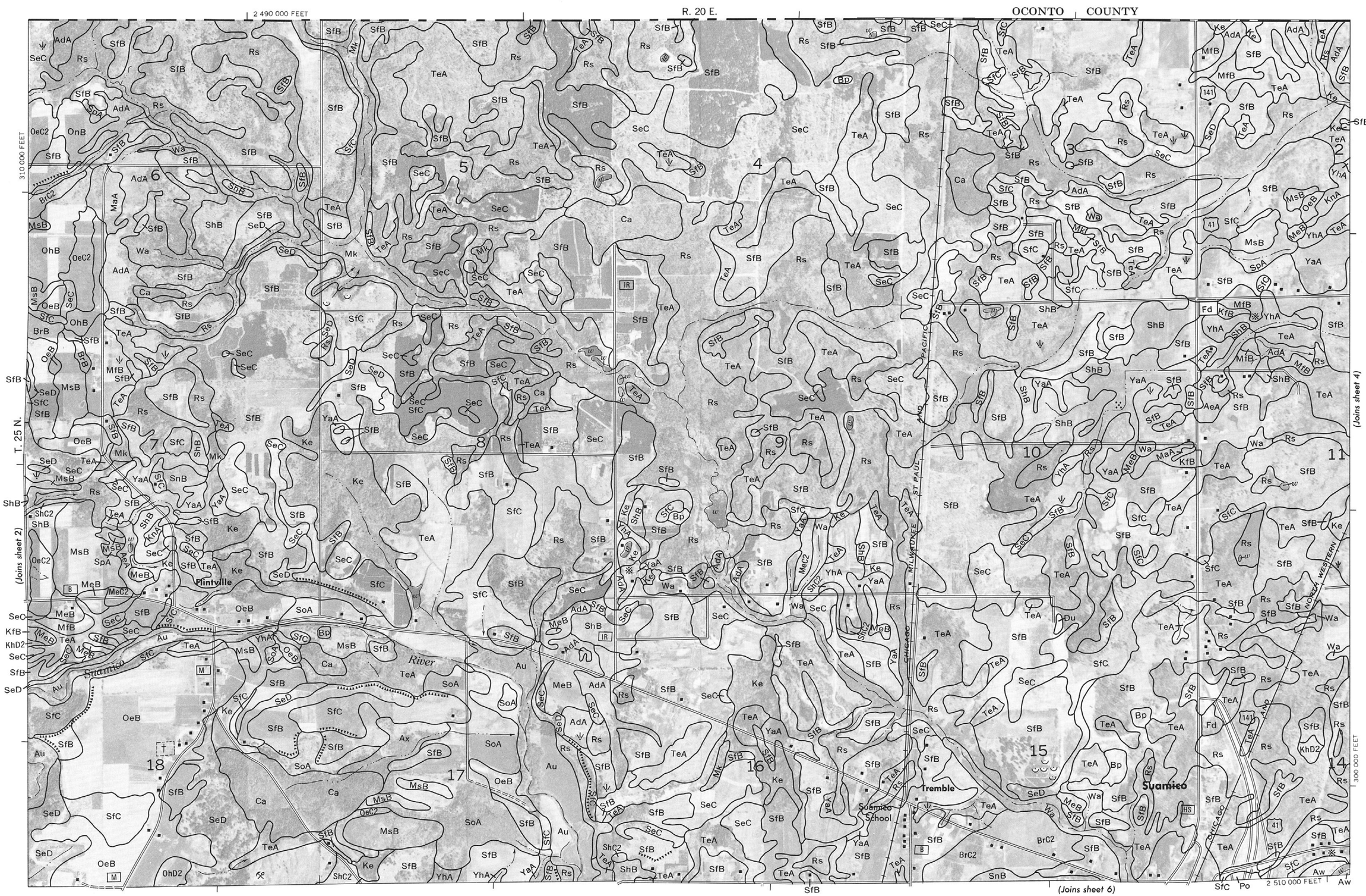

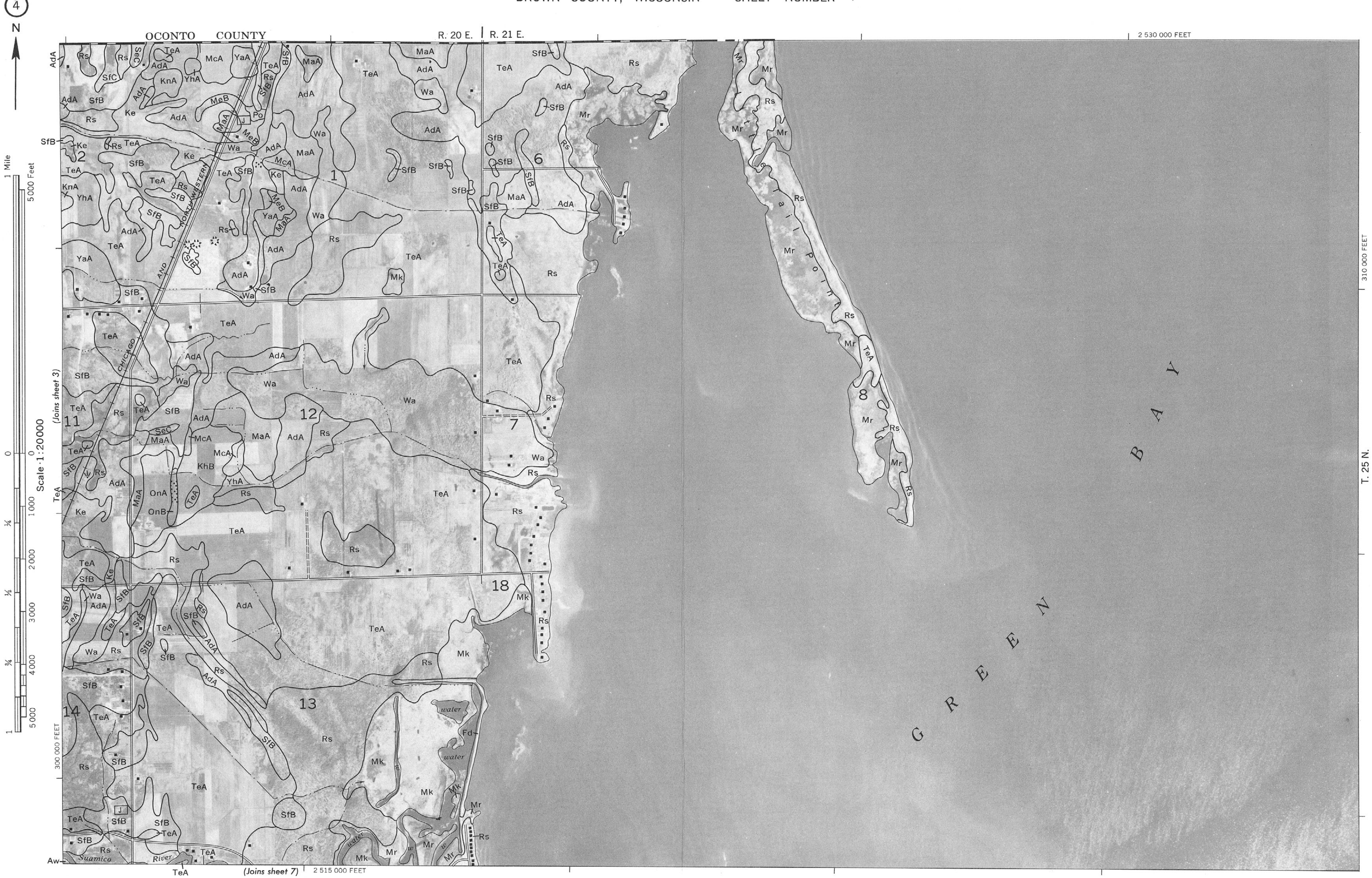

BROWN COUNTY, WISCONSIN NO. 4

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 5

2 465 000 FEET — R. 19 E — (Joins sheet 2)

295 000 FEET — T. 25 N.

(Joins inset A, sheet 1)

(Joins sheet 6)

(Joins sheet 10)

2 485 000 FEET

Kunesh — Anston — Mill Center

CHICAGO AND NORTH WESTERN

CHICAGO AND NORTHWESTERN

River

Suamico

5

N

1 Mile

5000 Feet

Scale 1:20000

6

N

R. 20 E.

T. 25 N.

T. 24 N.

2 510 000 FEET

2 490 000 FEET

295 000 FEET

285 000 FEET

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 11)

Suamico

SUAMICO RIVER

CHICAGO AND NORTH WESTERN

MILWAUKEE

CHICAGO

1 Mile

5 000 Feet

Scale · 1 : 20000

BROWN COUNTY, WISCONSIN NO. 6

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 7

N

R. 20E.

T. 25 N.

(Joins sheet 4)

2 515 000 FEET Mk

295 000 FEET

(Joins sheet 6)

(Joins sheet 12)

(Joins sheet 8)

285 000 FEET

2 535 000 FEET

SUAMICO RIVER

Suamico

Dead Horse Bay

GREEN BAY

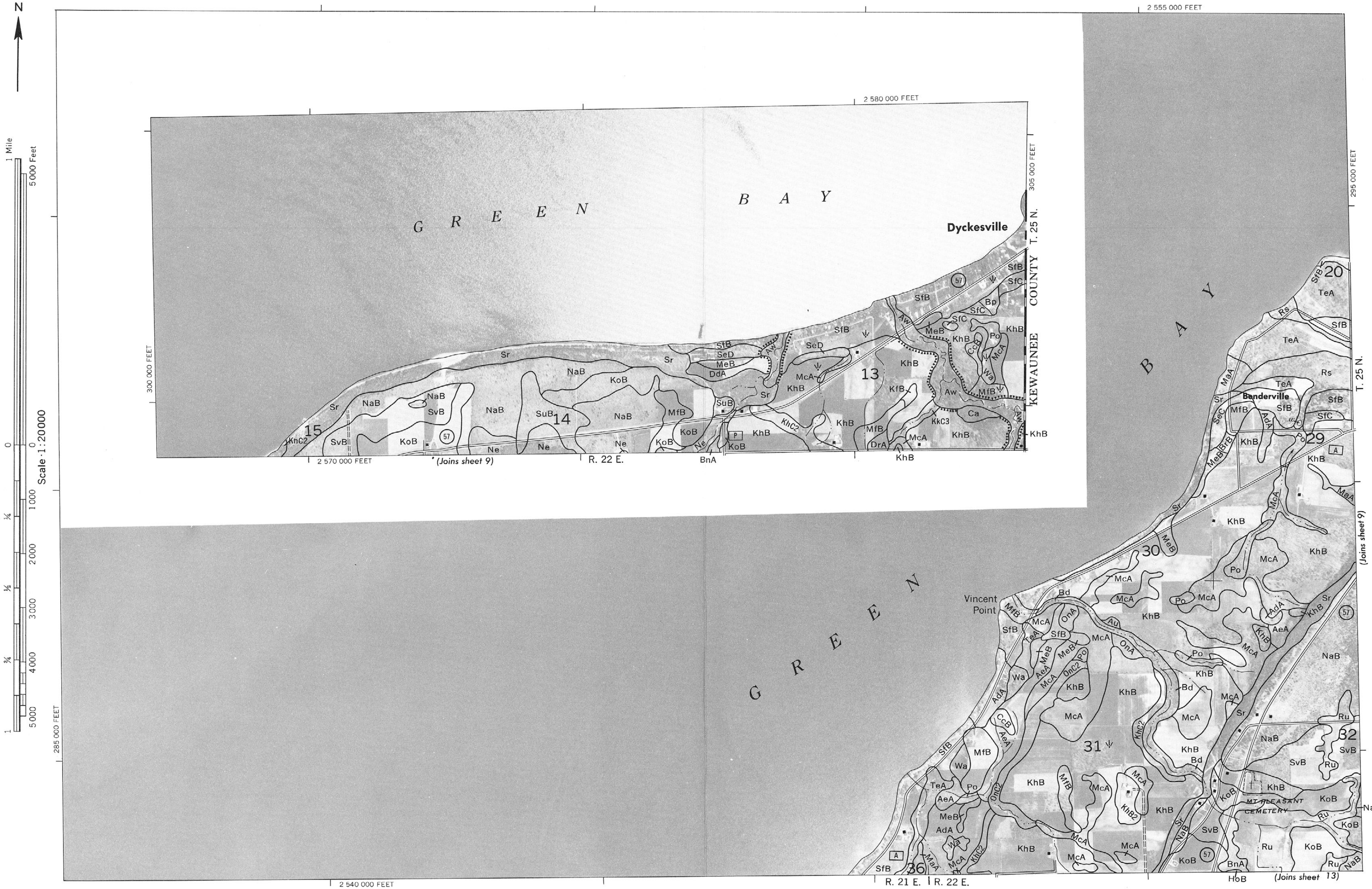
LONG TAIL POINT

LONG TAIL POINT NATIONAL WILDLIFE RUFUGE

23 24 25 26 31 32 35 36

Rs TeA SfB Mr water w

1 Mile
5000 Feet
Scale 1:20000



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.
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Land division corners are approximately positioned on this map.

N

R. 22 E.

2 560 000 FEET

295 000 FEET

T. 25 N.

G R E E N B A Y

Red Banks

(Joins sheet 8)

(Joins inset, sheet 8)

(Joins sheet 14)

2 580 000 FEET

285 000 FEET

KEWAUNEE COUNTY

Champion

Our Lady Chapel

1 Mile

5000 Feet

Scale 1:20000

10

N

R. 19 E.

(Joins sheet 5)

(Joins inset, sheet 1)

OUTAGAMIE COUNTY

Mill Center

T. 24 N.

(Joins sheet 11)

(Joins sheet 15)

2 485 000 FEET

280 000 FEET

265 000 FEET

2 465 000 FEET

Scale 1:20000

1 Mile

5000 Feet

0 0

1 5000 ¾ 4000 ½ 3000 ¼ 2000 0 1000

Tributary

Creek

BROWN COUNTY, WISCONSIN NO. 10

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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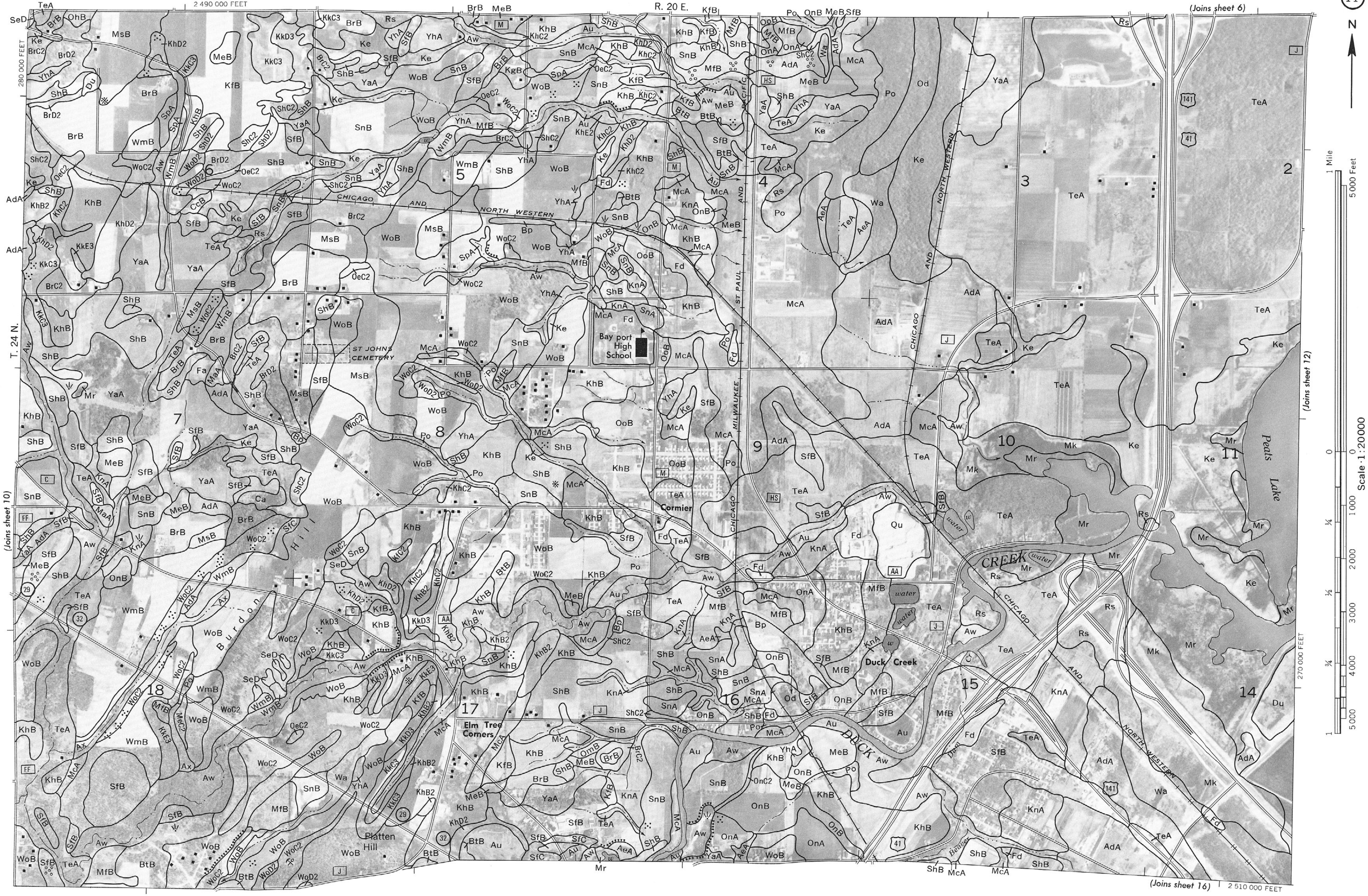

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.
Land division corners are approximately positioned on this map.

12

N

R. 20 E.

2 535 000 FEET

280 000 FEET

270 000 FEET

T. 24 N.

(Joins sheet 7)

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 17)

2 515 000 FEET

LONG TAIL POINT NATIONAL WILDLIFE RUFUGE

Dead Horse Bay

Peats Lake

G R E E N B A Y

Duck Creek

Long Tail Point

1 Mile

5000 Feet

Scale · 1:20000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

TeA Rs Ke Mr Du Fd Wa

1 2 5 13 14

BROWN COUNTY, WISCONSIN NO. 12

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.
Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 13

2 540 000 FEET

R. 21 E. | R. 22 E.

(Joins sheet 8)

280 000 FEET

T. 24 N.

G R E E N B A Y

Point au Sable

Benderville School

Wequiock

Bay Settlement

HOLY CROSS CEMETERY

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 18)

270 000 FEET

2 555 000 FEET

13

N

1 Mile

5000 Feet

Scale 1:20000

BROWN COUNTY, WISCONSIN — SHEET NUMBER 14

14

N

(Joins sheet 9)

R. 22 E.

Robinsonville Church

Champion

2 580 000 FEET

280 000 FEET

T. 24 N.

(Joins sheet 13)

2 560 000 FEET

270 000 FEET

(Joins sheet 19)

KEWAUNEE COUNTY

BROWN COUNTY, WISCONSIN NO. 14

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Wisconsin Agricultural Experiment Station.

1 Mile

5000 Feet

Scale 1:20000

0 0 1000 2000 3000 4000 5000

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 15

2 465 000 FEET

260 000 FEET

R. 19 E.

T. 24 N.

COUNTY

OUTAGAMIE

(Joins sheet 10)

(Joins sheet 16)

(Joins sheet 20)

2 485 000 FEET

250 000 FEET

BROWN COUNTY GOLF COURSE

Oneida

GREEN BAY

WESTERN

DUCK CREEK

Creek

Scale 1:20000

1 Mile

5000 Feet

N

BROWN COUNTY, WISCONSIN — SHEET NUMBER 16

16

N

R. 20 E.

T. 24 N.

2 510 000 FEET

265 000 FEET

2 490 000 FEET

250 000 FEET

(Joins sheet 11)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 21)

HOWARD

GREEN BAY
(county seat)

Southwest High School

FORT HOWARD CEMETERY

CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC

CHICAGO AND WESTERN PACIFIC

DUCK CREEK

Bower Dam Creek

Scale 1:20000

1 Mile

5000 Feet

BROWN COUNTY, WISCONSIN NO. 16

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 17

R. 20 E.

2 515 000 FEET

265 000 FEET

(Joins sheet 12)

17

N

GREEN BAY

FOX RIVER

EAST RIVER

GREEN BAY (county seat)

Haevers Corners

Preble

Baird Creek

UNIV OF WISC DECKNER CAMPUS

CHICAGO AND NORTH WESTERN

GREEN BAY AND WESTERN

CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC

T. 24 N.

R. 21 E.

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 22)

2 535 000 FEET

255 000 FEET

1 Mile

5000 Feet

Scale 1:20000

BROWN COUNTY, WISCONSIN — SHEET NUMBER 18

18

N

R. 21 E. | R. 22 E.

2 555 000 FEET

265 000 FEET

T. 24 N.

(Joins sheet 13)

(Joins sheet 19)

(Joins sheet 17)

(Joins sheet 23)

2 540 000 FEET

255 000 FEET

GREEN BAY

NICOLET GARDENS CEMETERY

Bay Ridge School

Chapel Ridge

UNIVERSITY OF WISCONSIN GREEN BAY

COUNTY HOME CEMETERY

Baird Creek

GREEN BAY AND WESTERN

1 Mile

5000 Feet

Scale 1:20000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

BROWN COUNTY, WISCONSIN NO. 18

Land division corners are approximate and based on the Wisconsin coordinate system, central zone.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 19

N

2 560 000 FEET

265 000 FEET

R. 22 E.

(Joins sheet 14)

T. 24 N.

(Joins sheet 18)

(Joins sheet 24)

2 580 000 FEET

255 000 FEET

KEWAUNEE COUNTY

1 Mile

5 000 Feet

Scale 1:20 000

New Franken

Humboldt

Sugar Bush

ST KILLIAN CEMETERY

WESTERN AND GREEN BAY

Creek

School

20

N

1 Mile

5000 Feet

0 0

Scale 1:20000

1 000 2000 3000 4000 5000

¼ ½ ¾ 1

R. 19 E.

T. 23 N.

2 485 000 FEET

245 000 FEET

235 000 FEET

2 465 000 FEET

OUTAGAMIE COUNTY

(Joins sheet 15)

(Joins sheet 21)

(Joins sheet 25)

Oneida

AUSTIN-STRAUBEL AIRPORT

High View School

Duck Creek

Dutchman Creek

BROWN COUNTY, WISCONSIN NO. 20

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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BROWN COUNTY, WISCONSIN NO. 21

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximately positioned and based on the Wisconsin coordinate system, central zone.
Land division corners are approximately positioned on this map.

22

N

(Joins sheet 17)

R. 21 E.

2 535 000 FEET

SnB

250 000 FEET

T. 23 N.

(Joins sheet 23)

GREEN BAY
(county seat)

RIVER

FOX

WOODLAWN CEMETERY

ALLOUEZ CEMETERY

CHICAGO AND NORTH WESTERN

CHICAGO AND NORTH WESTERN

ALLOUEZ

EAST

DE PERE

State Reformatory

Preble

(Joins sheet 21)

(Joins sheet 27)

2 515 000 FEET

235 000 FEET

1 Mile

5000 Feet

Scale · 1 : 20000

BROWN COUNTY, WISCONSIN NO. 22

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BROWN COUNTY, WISCONSIN NO. 23

N

R. 21 E. | R. 22 E.

T. 23 N.

2 540 000 FEET

250 000 FEET

240 000 FEET

2 555 000 FEET

(Joins sheet 18) MfB

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 28)

Gorcum Church

BELLEVUE CEMETERY

GREEN BAY AND WESTERN

Baird Creek

1 Mile

5 000 Feet

Scale 1:20000

24

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 19)

(Joins sheet 23)

(Joins sheet 29)

R. 22 E.

T. 23 N.

2 580 000 FEET

250 000 FEET

240 000 FEET

2 560 000 FEET

ST MARYS CEMETERY

Coppens Corner

KEWAUNEE COUNTY

BROWN COUNTY, WISCONSIN NO. 24

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 25

2 465 000 FEET

230 000 FEET

R. 19 E.

(Joins sheet 20)

T. 23 N.

OUTAGAMIE COUNTY

WILLIAMS GRANT

(Joins sheet 26)

(Joins sheet 30)

2 485 000 FEET

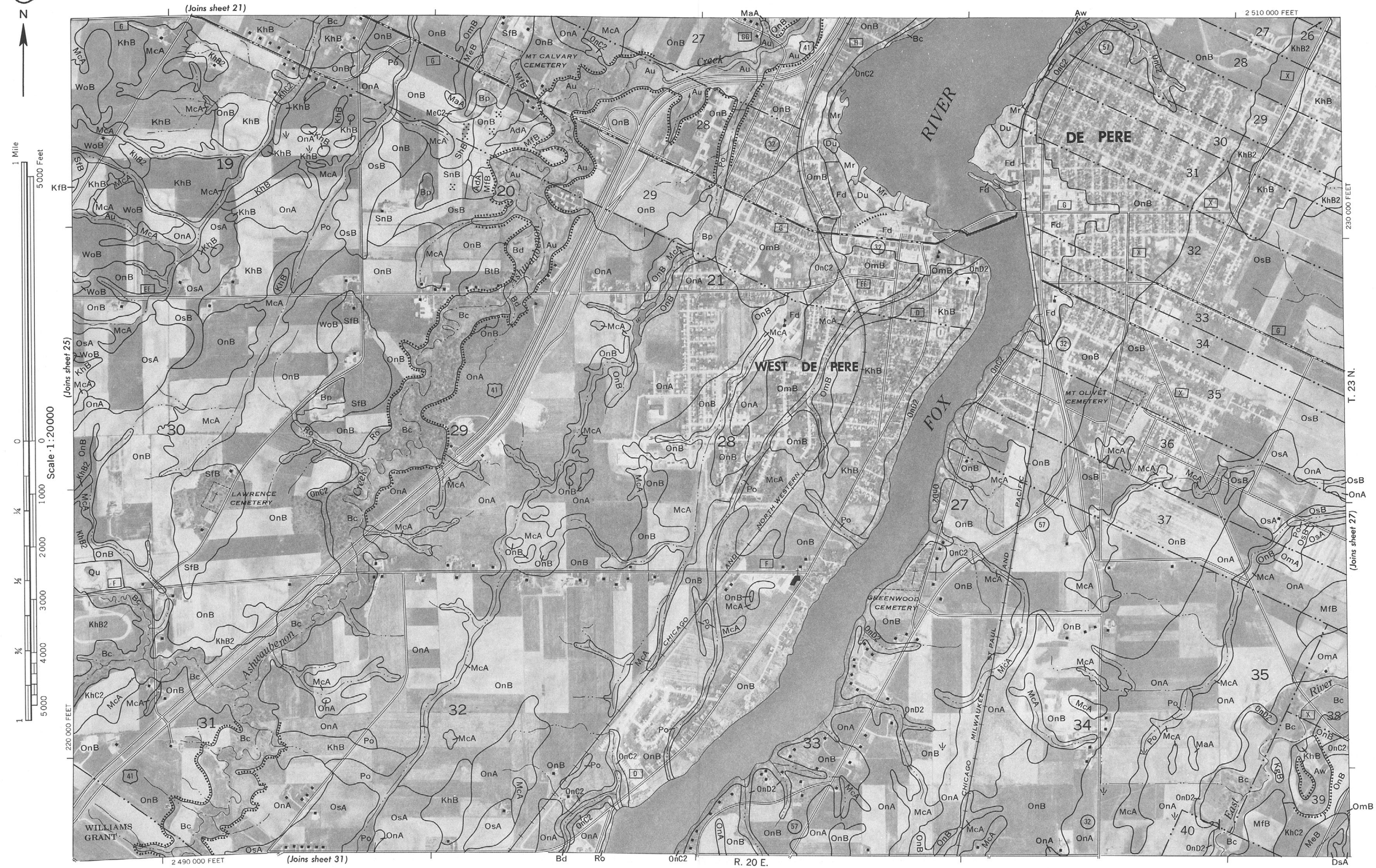
220 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20000



BROWN COUNTY, WISCONSIN NO. 26

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

(Joins sheet 22)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 32)

DE PERE
Kolb
East River
Bower Creek
Creek
water

T. 23 N.
R. 20 E. | R. 21 E.
2 515 000 FEET
2 535 000 FEET
230 000 FEET
220 000 FEET

Scale 1:20000
1 Mile
5000 Feet
N

28

N

R. 21 E. | R. 22 E.

T. 23 N.

2 555 000 FEET

235 000 FEET

220 000 FEET

2 540 000 FEET

(Joins sheet 23)

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 33)

Scale 1:20000

1 Mile

5000 Feet

Spring Creek School

Bellevue

West Eaton School

LILY LAKE CEMETERY

Elm View School

St Pauls Church

Pine Grove

Bower Creek

Suamico River

Yeshota Creek

CHICAGO AND NORTH WESTERN

BROWN COUNTY, WISCONSIN NO. 28

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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Land division corners are approximately positioned on this map.

WISCONSIN NO. 29

BROWN COUNTY, WISCONSIN

2 560 000 FEET

235 000 FEET

R. 22 E.

T. 23 N.

(Joins sheet 24)

(Joins sheet 28)

(Joins sheet 34)

2 580 000 FEET

220 000 FEET

Coppens Corner

LITTLE IRISH CHURCH CEMETERY

Poland

Henryville

Emmanuel Church

Lilly Lake

Middle Lake

Third Lake

King Creek

Buckman

KEWAUNEE COUNTY

N

1 Mile

5000 Feet

Scale 1:20000

30

N

1 Mile

5000 Feet

Scale · 1:20000

0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

(Joins sheet 25)

2 485 000 FEET

215 000 FEET

205 000 FEET

2 465 000 FEET

T. 22 N.

R. 19 E.

OUTAGAMIE COUNTY

WILLIAMS

GRANT

Gopher Hill

North Branch

South Branch

Creek

Little Rapids

CHICAGO NORTH WESTERN LAND

FOX R

(Joins sheet 31)

(Joins sheet 35)

BROWN COUNTY, WISCONSIN NO. 30

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 31

N

R. 20 E.

2 490 000 FEET

215 000 FEET

(Joins sheet 26)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 36)

2 510 000 FEET

205 000 FEET

T. 22 N.

WILLIAMS

GRANT

RIVER

FOX

Little Rapids

LITTLE KAUKAUNA LOCK AND DAM

Creek

Ashwaubenon

River

East

NORTH WESTERN

CHICAGO AND

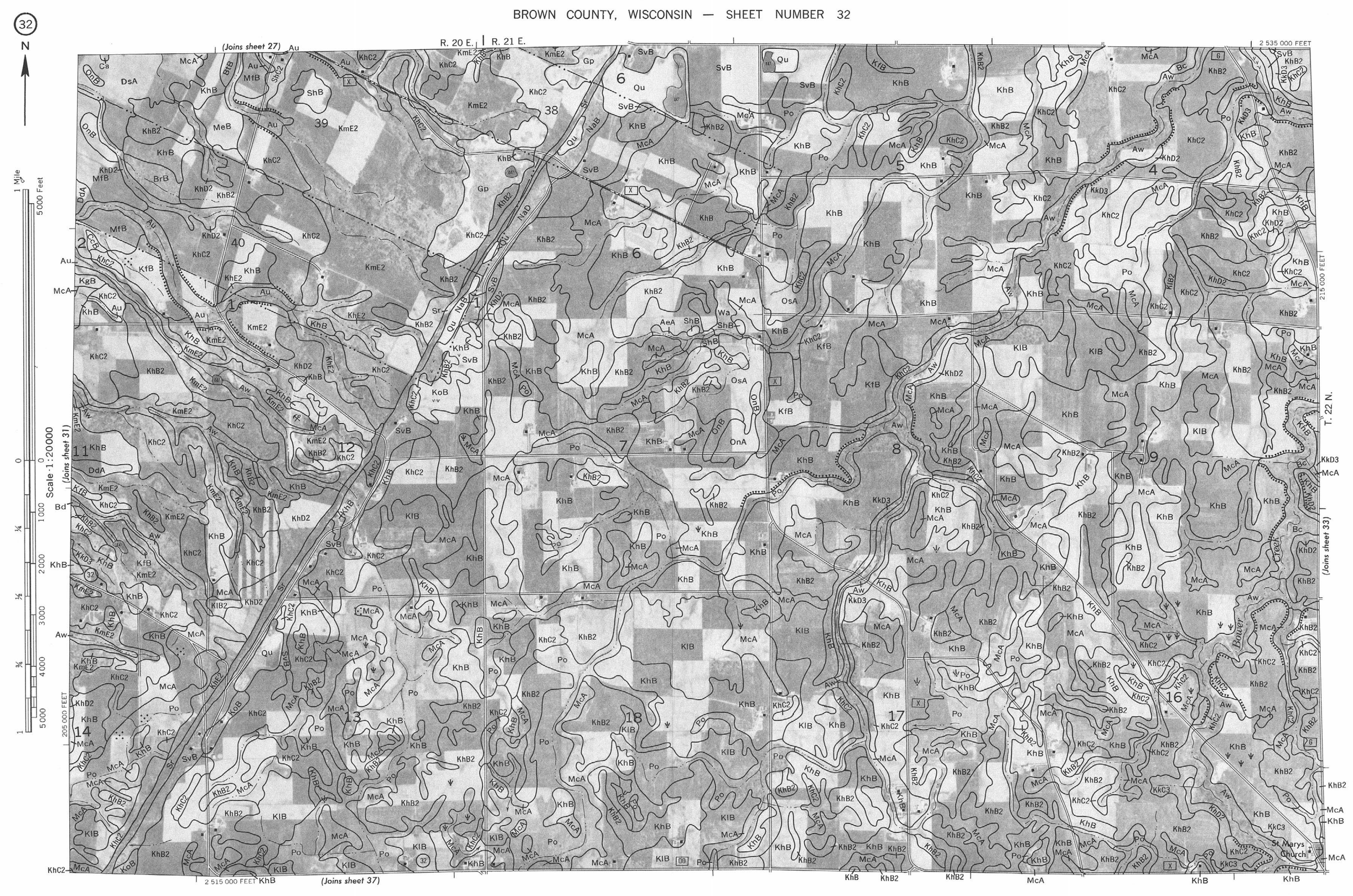
PACIFIC AND

CHICAGO ST PAUL MILWAUKEE

1 Mile

5000 Feet

Scale 1:20000



BROWN COUNTY, WISCONSIN NO. 32

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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Land division corners are approximately positioned on this map.

N

R. 21 E. | R. 22 E.

T. 22 N.

2 540 000 FEET

215 000 FEET

205 000 FEET

2 560 000 FEET

(Joins sheet 28)

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 38)

Pine Grove

Holy Trinity Church

Neshota

Glenmore

Langes Corners

Scale 1:20000

1 Mile

5000 Feet

34

N

(Joins sheet 29)

R. 22 E.

2 580 000 FEET

2 565 000 FEET

215 000 FEET

205 000 FEET

T. 22 N.

(Joins sheet 33)

(Joins sheet 39)

Neshota River

King Creek

Neshota River

CHICAGO AND NORTH WESTERN

Buckman

Fontenoy

KEWAUNEE COUNTY

1 Mile 5 000 Feet

Scale 1:20000

BROWN COUNTY, WISCONSIN NO. 34

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Wisconsin Agricultural Experiment Station.

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.
Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 35

BROWN COUNTY, WISCONSIN — SHEET NUMBER 36

36

N

(Joins sheet 31)

R. 20 E.

2 510 000 FEET

200 000 FEET

T. 22 N.

(Joins sheet 35)

(Joins sheet 37)

1 Mile

5000 Feet

Scale · 1 : 20000

190 000 FEET

2 490 000 FEET

(Joins sheet 41)

BROWN COUNTY, WISCONSIN NO. 36

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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Land division corners are approximately positioned on this map.

R. 20 E. | R. 21 E.

2 515 000 FEET

200 000 FEET

T. 22 N.

(Joins sheet 32)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 42)

2 535 000 FEET

190 000 FEET

Immanuel School

Shirley

N

Scale 1:20000

1 Mile

5 000 Feet

38

N

R. 21 E. | R. 22 E.

2 560 000 FEET

T. 22 N.

200 000 FEET

(Joins sheet 33)

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 43)

2 540 000 FEET

190 000 FEET

Scale 1:20000

1 Mile

5000 Feet

0

1 000

2 000

3 000

4 000

5 000

1

½

¾

Shirley

Hebel

Holy Trinity Church

Pelishek Corners

MANITOWOC COUNTY

BROWN COUNTY, WISCONSIN NO. 38

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 39

(Joins sheet 34)

(Joins sheet 38)

R. 22 E.

T. 22 N.

2 565 000 FEET

200 000 FEET

2 580 000 FEET

190 000 FEET

Denmark High School

Trinity Church

Christ Church

Denmark

Fontenoy

Bouchman Cemetery

Chicago and North Western

Neshota

River

MANITOWOC COUNTY

KEWAUNEE COUNTY

N

1 Mile

5000 Feet

Scale 1:20000

40

N

Scale · 1 : 20000

1 Mile 5 000 Feet

0 0

1/4 1000

1/2 2000

3/4 4000

1 5000

R. 19 E.

2 485 000 FEET

185 000 FEET

175 000 FEET

2 470 000 FEET

T. 21 N.

(Joins sheet 35)

(Joins sheet 41)

(Joins sheet 44)

Wrightstown

Wrightstown High School

ST JOHNS CEMETERY

FOX RIVER

Plum Creek

OUTAGAMIE COUNTY

CHICAGO AND NORTH WESTERN

BROWN COUNTY, WISCONSIN NO. 40

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 41

41

N

2 490 000 FEET

185 000 FEET

R. 20 E.

T. 21 N.

(Joins sheet 36)

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 45)

2 510 000 FEET

175 000 FEET

Greenleaf

FAIRVIEW CEMETERY

St Marys School

River

EAST

ST PAUL AND PACIFIC

MILWAUKEE CHICAGO

1 Mile

5000 Feet

Scale 1:20000

BROWN COUNTY, WISCONSIN — SHEET NUMBER 42

42

N

(Joins sheet 37) | R. 20 E. | R. 21 E.

2 535 000 FEET

185 000 FEET

T. 21 N.

(Joins sheet 41)

(Joins sheet 43)

2 515 000 FEET

(Joins sheet 46)

1 Mile

5 000 Feet

Scale · 1:20000

Lark

Morrison

Zion School

St Johns Church

EMMANUEL CEMETERY

Branch River

BROWN COUNTY, WISCONSIN NO. 42

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Land division corners are approximately positioned on this map.

BROWN COUNTY, WISCONSIN NO. 43

N

2 540 000 FEET

R. 21 E.

(Joins sheet 38)

185 000 FEET

T. 21 N.

(Joins sheet 42)

(Joins sheet 47)

2 560 000 FEET

MANITOWOC COUNTY

175 000 FEET

Devils River

Lark

Emmanuel Church

St Marys Church

Scale · 1:20000

1 Mile

5000 Feet

44

N

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Scale 1:20000

(Joins sheet 40)

R. 19 E.

2 485 000 FEET

170 000 FEET

T. 21 N.

(Joins sheet 45)

155 000 FEET

2 470 000 FEET

OUTAGAMIE COUNTY

CALUMET COUNTY

Holland

Plum Creek

22 23 24 25 26 27 34 35 36

BROWN COUNTY, WISCONSIN NO. 44

Land division corners are approximately positioned on this map.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Wisconsin coordinate system, central zone.

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Land division corners are approximately positioned on this map.

N

R. 20 E.

T. 21 N.

2 490 000 FEET

170 000 FEET

(Joins sheet 41)

(Joins sheet 44)

(Joins sheet 46)

Askeaton

EAST TWIN River

CHICAGO MILWAUKEE ST PAUL PACIFIC

19 20 21 22 23 26 27 28 29 30 31 32 33 34 35

Scale 1:20000

1 Mile 5000 Feet

0 1000 2000 3000 4000 5000

¼ ½ ¾ 1

155 000 FEET

2 510 000 FEET

CALUMET COUNTY

MANITOWOC COUNTY

Land division corners are approximately positioned on this map.

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Land division corners are approximately positioned on this map.

2 540 000 FEET

170 000 FEET

R. 21 E.

(Joins sheet 43)

T. 21 N.

(Joins sheet 46)

MANITOWOC COUNTY

MANITOWOC COUNTY

160 000 FEET

2 560 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20000

Wayside

Bay of Green Bay

Branch River

Branch River